

# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



## THESIS

### **A DEPARTMENT OF DEFENSE RETIREMENT SYSTEM FOR THE FUTURE**

by

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June 2002

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<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> June 2002	<b>3. REPORT TYPE AND DATES COVERED</b> Master's Thesis	
<b>4. TITLE AND SUBTITLE:</b> A Department of Defense Retirement System for the Future			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b> Gary L. Jacobsen				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Postgraduate School Monterey, CA 93943-5000			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> N/A			<b>10. SPONSORING/MONITORING AGENCY REPORT NUMBER</b>	
<b>11. SUPPLEMENTARY NOTES</b> The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (maximum 200 words)</b>  The current military retirement system has come under much scrutiny in recent years. Much of this scrutiny has been a result of the high cost of the system. Many studies have been undertaken in attempts to develop a retirement system for military personnel that would reduce the cost. Congress has acted several times in recent decades on these proposals. In all but one instance, the result has been lowering system costs by reducing retiree benefits. The goal of this study was to examine the objectives of the military retirement system for the purpose of determining if a retirement system could be developed that would lower system costs while simultaneously meeting the objectives of the current system and maintaining the retirees perceived retirement entitlements at their current level. The result of the study is a proposed multi-option retirement system for the military that is better aligned with the DoD retirement system objectives and reduces the system cost while simultaneously enhancing future retiree entitlement potential. The model costs and benefits are analyzed using a Monte Carlo type simulation model to more accurately predict future results and allow for analysis of various modifications to the proposal.				
<b>14. SUBJECT TERMS</b> Military Retirement, Monte Carlo simulation, Alternative retirement system, DoD Retirement system objectives, Retirement system costs, Retirement system benefits			<b>15. NUMBER OF PAGES</b> 151	
			<b>16. PRICE CODE</b>	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b> UL	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18

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**A DEPARTMENT OF DEFENSE RETIREMENT SYSTEM FOR THE FUTURE**

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Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

from the

**NAVAL POSTGRADUATE SCHOOL  
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## **ABSTRACT**

The current military retirement system has come under much scrutiny in recent years. Much of this scrutiny has been a result of the high cost of the system. Many studies have been undertaken in attempts to develop a retirement system for military personnel that would reduce the cost. Congress has acted several times in recent decades on these proposals. In all but one instance, the result has been lowering system costs by reducing retiree benefits. The goal of this study was to examine the objectives of the military retirement system for the purpose of determining if a retirement system could be developed that would lower system costs while simultaneously meeting the objectives of the current system and maintaining the retirees perceived retirement entitlements at their current level. The result of the study is a proposed multi-option retirement system for the military that is better aligned with the DoD retirement system objectives and reduces the system cost while simultaneously enhancing future retiree entitlement potential. The model costs and benefits are analyzed using a Monte Carlo type simulation model to more accurately predict future results and allow for analysis of various modifications to the proposal.

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## **ACKNOWLEDGMENTS**

I would like to thank Professors Liao and Mutty for their patience, support, and guidance while I prepared this study.

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# **I. INTRODUCTION**

## **A. BACKGROUND**

The existing military retirement system of the Department of Defense (DoD) has come under ever-increasing scrutiny in recent years. While there are many reasons given for the increased interest, most stem from concerns over the cost of the existing defined benefit system. The migration of most civilian organizations and federal employees to a defined contribution plan vice a defined benefit plan further enhances interest in why the military has not followed suit. There is also a concern that the current system, under which benefits commence immediately upon retirement, is no longer in the best interest of the taxpayer or the DoD. A review of the objectives of the military retirement system and analyses of how well the objectives are being met naturally follows given the current push for a more cost efficient military as a whole.

## **B. PURPOSE**

The purpose of this thesis is to clearly define the objectives of the military retirement system and analyze the degree to which these objectives are met by the current retirement system. Once this has been done, one has a strong footing with which to consider alternative retirement options and to evaluate to what degree these options could meet the stated objectives. This can be done with an end goal of developing the best possible system for meeting the stated objectives. Once this retirement system has been found, one must then consider the costs and benefits of transitioning to this new system. This research has done that through the development of a simulation model for forecasting the cost savings/loss from adopting a program other than the current model.

## **C. RESEARCH QUESTIONS**

**The primary question that this thesis addresses is:** Given the current objectives of the DoD retirement system; can the needs of both the DoD and today's potential military entrants be better met by development of a new multi-option type retirement system than by the current defined benefit system?

**Secondary questions that have been addressed include the following:**

- What are the objectives of the retirement system and does the current system meet them?
- How would a multi-option retirement system be structured to meet the objectives of the DoD retirement?
- What, if any, cost savings can be attained by implementing the aforementioned multi-option retirement system?
- What effect would the transition to a new retirement system have on personnel accessions as well as retention?

**D. SCOPE AND LIMITATIONS**

This thesis includes an inspection and evaluation of the stated objectives of the military retirement system. Once the objectives have been clearly defined, one can more intelligently evaluate the effectiveness of the current retirement system at meeting the objectives and identify areas for potential improvement. Armed with a thorough understanding of the objectives and the strengths and weaknesses of the existing retirement system, one is then prepared to evaluate/develop alternative retirement plans. Based on findings from analysis of previously recommended retirement options, or versions of those options, this thesis develops a multi-option type retirement system that, in theory, will better meet the stated objectives of the retirement system. The thesis then provides a simulation type model to perform a cost-benefit analysis of the existing and newly developed model and provides analytical results of the potential cost and benefit differences between the two systems. Based on an understanding of the objectives and model output one can then make an informed decision as to whether or not the new model should be considered for incorporation or if the existing system better meets the objectives.

Because of the complexity and immense size of the military pay system, this thesis looks only at the entitlements that directly affect the retirement system. While recognizing that some individuals feel the objectives of the military retirement system need to be modified, this thesis assumes the current objectives are a solid base upon which to build a new retirement system. The validity of this assumption is based on the objectives having withstood numerous past reviews with little noteworthy change.

## **E. METHODOLOGY**

The research methodology relied heavily on data gathered by a review of previous private and government funded studies of the military and civilian sector retirement plans. Further data were gathered from congressional and senior military member testimony as well as printed data and Internet resources. The model developed to compare the existing and newly developed plans incorporates a “Monte Carlo” type simulation to reach statistically significant results. Based on the information in the evaluation, development, and simulation phase, recommendations for modification of, or changes to, the military retirement system are made.

## **F. THESIS ORGANIZATION**

This thesis utilizes seven chapters to present the analysis in an organized manner. An overview of the chapters follows:

### **1. Chapter I**

Chapter I discusses the background reasoning for performance of this study as well as defining what the purposes of the study are and how they will be accomplished.

### **2. Chapter II**

Chapter II examines the existing objectives of the DoD military retirement system. The examination includes a discussion of the objectives with respect to the following areas: promotion, general competitiveness with civilian counterparts, overall manpower control, and reasonableness of cost. A discussion of the key elements of each area and why they are important to the overall military mission is included.

### **3. Chapter III**

Chapter III gives the background of the existing retirement system. This discussion includes the costs and benefits the system offers the military as well as some criticisms, both long-standing and recent. The current system is then evaluated against

the objectives detailed in Chapter II to determine to what degree the existing system and the objectives are aligned.

#### **4. Chapter IV**

Chapter IV discusses various retirement plan options offered for DoD consideration by both government and non-government entities. The plans are summarized and evaluated against the objectives to determine the degree to which they would be feasible for consideration as a new DoD retirement plan. An evaluation of the strengths and weaknesses of the plans is also given.

#### **5. Chapter V**

Chapter V encompasses the discussion and analysis utilized when considering how to best develop a multi-option retirement system. Data from previous chapters, such as plan strengths and weaknesses as well as alignment with the objectives, were integrated for consideration when developing the new plan. The final product is a multi-option retirement system that better meets the objectives of the military retirement system and the needs/desires of today's potential military accessions.

#### **6. Chapter VI**

Chapter VI gives a background into why the simulation model is appropriate for use as an analysis tool in this instance as well as defining the assumptions that are inherent to the model. An understanding of the assumptions made and limitations on input variability are critical if one hopes to get meaningful and accurate results from running the simulation. This model is then used to compare the costs and benefits of the existing military retirement system and the one developed in chapter V.

#### **7. Chapter VII**

Chapter VII summarizes the findings of the thesis and makes recommendations for and against changing the existing retirement system. A discussion of the pros and cons to change are included as well as answers to the research questions posed in Chapter

I. A discussion of areas for further research with respect to this study is also incorporated.

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## **II. THE OBJECTIVES OF THE DOD MILITARY RETIREMENT SYSTEM**

### **A. OVERVIEW OF THE DOD MILITARY RETIREMENT SYSTEM OBJECTIVES AND PURPOSES**

A discussion of the validity of the current DoD military retirement system or any proposed changes to the retirement system cannot be meaningful without first understanding the objectives and purposes on which the system is based. There are many entities, both governmental and private, that have offered recommendation on modifications to, and/or complete restructuring of, the existing retirement system. One theme consistent to nearly all of the studies is an adherence to the stated objectives that the DoD retirement system is tasked with achieving. The objectives are based on the military retirement system meeting the needs of both the nation and its military service members. Some studies have challenged the applicability and validity of the objectives, but all attempts at changing them have been thwarted. We will now discuss the objectives that lay the groundwork for the remainder of the thesis.

The DoD, via the Office of the Actuary, annually produces a report, *Valuation of the Military Retirement System*, which defines the DoD's perspective on the principles that guide the military retirement system's purpose and evolution:

The principle motivations guiding the evolution of the military retirement system have been to ensure that (1) continued service in the armed forces is competitive with the alternatives, (2) promotion opportunities are kept open for young and able members, (3) some measure of economic security is made available to members after retirement from a military career, (4) a pool of experienced personnel is available for recall in times of war or national emergency, and (5) the costs of the system are reasonable. (Ref. 1 p. B-2)

A second source of data for the basis of the military retirement system is the *Military Compensation Background Papers* produced by the Office of the Secretary of Defense. A review of the papers reveals the following objectives:

- The provision of a socially acceptable level of payments to former members of the armed forces during their old age.
- The provision of a pool of experienced military manpower that can be called upon in time of war or other national emergency to augment the active duty forces of the United States.
- The provision of a retirement system that will enable the armed forces to remain generally competitive with private-sector employers and the federal civil service.
- The provision of a socially acceptable means of keeping the military forces of the United States young and vigorous, thereby insuring promotion opportunities for the younger members (Ref. 2 p. 50)

The objectives of the military retirement system have remained nearly unchanged over time even with the level of attention and subsequent changes that the retirement system has undergone in recent years. Reviewing the findings of the Fifth Quadrennial Review of Military Compensation, (QRMC) completed in 1984 reveals the following objectives. (Ref 8, p. IV-1)

The fundamental purpose of the Uniformed Services retirement system, strongly supported by the Fifth QRMC, is to support and complement the manpower force management requirements of the Services in order to meet national security objectives. It is designed to help ensure that the following vital needs are fulfilled:

1. To maintain young, vigorous and mission-ready forces capable of operating efficiently both in peace and war by providing for a continuing flow of officers and enlisted personnel through the Services' required personnel structures.
2. To Establish the choice of a career in the Uniformed Services as a reasonably competitive alternative by providing a measure of financial security after release from active or reserve duty (retirement) for service members and their survivors.
3. To support a mobilization base of experienced personnel subject to recall to active duty during time of war or national emergency.

The wording of the three sets of objectives is not identical, but the overall intentions are very well aligned. One can see from these lists that the military retirement system is not solely intended for use as a basis for paying retired service members a pension. The system must also serve as a manpower control tool as well as being socially acceptable in terms of benefits provided to the retiree and cost to the taxpayer. Also missing from these sources is how the objectives are to be realized. The objectives, while consistent in content in all three documents, are just the end goals. This leaves the task of determining how to best meet the requirements of the objectives and that of the nation to the retirement system developer/implementer, in this case the DoD.

## **B. ANALYSIS OF THE OBJECTIVES**

### **1. Providing for the Economic Needs of the Retired**

The objective of paying or rewarding retired employees at an equitable rate for services rendered while employed is common to all retirement systems. The military retirement system differs from civilian counterparts in that the amount a retiree is paid is a matter of public record and is, in effect, paid by every taxpayer. This makes determining the amount and structure of the pay a much more complex issue. Trying to balance the overwhelming movement towards cost cutting and money saving that is ongoing in Congress today with maintaining a feasible pay rate to military retirees is an unenviable task. Further, determining what life-style/enumeration that a given retiree should be afforded is a subject of much debate. Maintaining the military retirement system payments at a competitive level with civilian and other federal service employees is also complicated by the perceived arduous nature and tasking of a service member's job. Further exasperating the complexity of meeting this requirement is the ongoing restructuring of civilian and federal civil service retirement systems. According to the Investment Company Institute, a mutual fund industry trade group, private and government-administered defined-benefit plans made up just 24% of the retirement market in 2000—down from 32% in 1990. (Ref 3, p.52) This evolution of the non-military retirement systems makes it more difficult for one to ensure that the military retirement system is equitable with its non-military counterparts.

## **2. Allowance for Maintaining a Young and Vigorous Force Structure**

Tasking a retirement system with manpower control issues such as maintaining a young and vigorous force structure as well as upward mobility further increases the complexity of the system's design. The goal of having a retirement system that is not only attractive to prospective military members, but also aids in affording those same new members a realistic promotion timeline is in itself an ambitious tasking. The system must not only achieve both of these aims, but also provide sufficient incentives to the service member to not stay on his/her job too long. One must prioritize which of these facets is most important when developing the retirement system. Ideally the system would be flexible enough to allow for the organization to modify it as necessary to meet the current manpower issues or demands. Designing flexibility into any system increases the complexity of the system, but is even more daunting in the case of the military retirement system. The reason that it is no small feat is that Congress must approve any significant changes to the military compensation system and appropriate funds to pay for the changes and associated costs accordingly on an annual basis.

## **3. Maintenance of a Pool of Readily Available Personnel**

An additional objective of the military retirement system is to maintain a readily accessible pool of retirees available for recall in the event of a war or other national emergency that is beyond the capability of the current active duty forces. While it may seem straightforward enough at first, determining the dollar-value of such a pool of personnel resources is much less clear. Further, once the dollar-value of the pool has been determined one must then decide how to incorporate this value equitably into the retirement system. How much should someone be paid for being "on call" for the remainder of his/her life? To further complicate the matter of placing a value on this resource pool is the fact that, to date, we have not had to call on these people to return to service. The lack of use of the pool forces one to consider lessening its value, conversely, the member, whose name is on the list, surely sees it as carrying a high cost or value.

#### **4. What is a Reasonable Cost to Society?**

The American taxpayers ultimately pay for the military retirement system costs. This places the onus of ensuring an equitable military retirement system on Congress, the taxpayers elected representatives. This facet again further complicates the design of the military retirement system in that once the DoD has developed a system to meet the pay and manpower objectives it must then convince Congress to pay for it. Congress is constitutionally mandated to control the “purse strings.” Thus once the system has been developed to meet all of the previously discussed objectives it must also be designed such that the Congress can justify its cost. In an era of cost cutting and deficit versus surplus budget wars, no program of any significant cost is above debate in Congress. This is evidenced by the increasing frequency with which the current military retirement system has come under fire in Congressional debates in recent years. No hard number exists for what is too much, but one must face the reality that as budget wars and cost cutting continue to be the way of the times, a program that cannot be fully justified will be reduced or eliminated. This places a further impetus on the DoD to ensure that the retirement system that it promises its members can be justly defended in the halls of Congress during the annual budget battles.

#### **C. SUMMARY**

The objectives of the military retirement system seem simple enough when first encountered, but as this discussion has shown, meeting all of the objectives is not an easy task. Developing a system that is in the best interest of the country and the service members requires a delicate balancing act. Concepts that seem simple when considered alone become entangled with other considerations and requirements when one tries to put together a retirement system that encompasses all of the objectives. Thus, what started out as two short lists of objectives have laid the groundwork for the chapters that follow. The thesis will next examine the existing system and discern to what degree it meets the objectives as described herein and then continue by evaluating various other potential military retirement system options and their alignment with the core objectives.

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### **III. THE EXISTING MILITARY RETIREMENT SYSTEM**

#### **A. INTRODUCTION**

A brief review of the origin and evolution of the military retirement system over the last 150 years lays the groundwork for a detailed discussion of today's system. Having laid the groundwork, the thesis will then discuss in detail the three retirement plans that encompass today's military service members. This discussion will include the costs and benefits of the various plans with respect to retiree entitlements, as well as an analysis of the three plans degree of alignment with the objectives outlined in Chapter II. A discussion of the Military Retirement Fund will also be undertaken to aid in the reader's ability to better understand and evaluate the costs associated with today's system. The newly incorporated Thrift Savings Plan and some recurring criticisms of the overall retirement system will also be considered.

#### **B. RETIREMENT SYSTEM HISTORY UP TO 1980**

The roots of today's military retirement system can be traced as far back as 1855. Military leaders of the time started to come to the realization that the need for some mechanism other than death was necessary in order to maintain a force structure that was physically capable of carrying out their tasking. Until this time there was no mandatory or voluntary retirement system in place and as such the military ranks included many old and incapable personnel. An 1855 statute was enacted giving the Secretary of the Navy the authority to involuntarily separate naval officers incapable of performing their duties through no fault of their own. Most officers separated under the statute were retired for reasons of age or medical disability. The officers were given compensation based on either 75% of sea duty pay (absence pay) or 50% of leave of absence pay (furlough pay). (Ref. 1, p. B-3) This act set in motion the framework for the follow-on act of August 3, 1861 that authorized officers of all branches of service an avenue for voluntary retirement, at the discretion of the President of the United States, after having served their

country for at least 40 years. (Ref 2, p. 512) The affects of the lack of authority to involuntarily retire aging forces was later described in a Congressional study as follows:

The unsatisfactory personnel conditions in the Regular Army which prompted these repeated recommendations of the War Department that Congress provide some form of retirement for the Regular Army were emphasized during the extended field service required over the period 1812-1861. While the law provided a pension of one-half pay for disabled officers, there existed no provision for compulsory separation from active service of old and disabled officers; there was no limit on active service save by dismissal or resignation of the officer. Thus, an officer could remain on active duty until death, despite incapacity due to old age, physical disability, etc. In consequence, many junior officers exercised commands in the field beyond their rank, the old and disabled officers who should have exercised these commands being left behind—often on leave—whenever field service was performed. (Ref. 2 p. 511)

Over the next 50 or so years many minor modifications were made to the military retirement system (Ref. 2 pp. 512-521). Then the Act of August 29, 1916 (Naval Service Appropriation Act of 1917) was enacted. This act was the first to introduce the up-or-out concept and initiated the use of the retirement pay formula that was to be the basis for calculating retiree pay until 1980. As one can see from this brief historical review, the retirement system originally came about as a result of need for a force management tool (for example - age control). While this discussion has been limited to the officer retirement plan the enlisted members retirement system was created and modified along a similar timeline and path. Modifications of the retirement system from 1916 until 1980 mainly encompassed making the various services' retirement systems more equitable.

### **C. 1980 TO THE PRESENT**

The Defense Authorization Acts of 1981, 1984, 1986, and 2000 all made significant changes to the military retirement system. As is evidenced by the four major changes occurring in less than a twenty-year period, the system has come under heavy fire and criticism in recent years. The 1981 and 1986 changes tended to lessen the value of the retirement system to the military member in hopes of resulting in cost savings to the taxpayer. The 1984 act changed the military accounting system with respect to the retirement system and resulted in the creation of the Military Retirement Fund, which



ultimately resulted in making the cost of the military retirement system much more readily apparent. The Defense Authorization Act of 2000 is, in effect, a partial repeal of the 1986 reductions to the retirement system. It also added the Thrift Savings Plan as a retirement tool available to service members. As a result of these acts, today's active duty service members fall into one of following three retirement payment systems.

### **1. Service Entry Prior to 1980**

Those members entering service prior to September 8, 1980 are covered under a retirement compensation plan commonly referred to as 'Final Pay.' The formula used for calculating a member's pension benefits is based upon the final monthly base pay the member achieves prior to retiring. The member receives 50% of his/her final base pay for completion of the first 20 years of service and an additional 2.5% for each year thereafter with a cap set at 75% of final base pay, regardless of length of service. Payments commence immediately upon the member's retirement and continue throughout the retiree's lifetime. The retiree's benefits are also protected against inflationary or cost of living increases by annually increasing at a rate equal to the annual Consumer Price Index (CPI) percentage. This type of inflation protection is referred to as full CPI protection or cost of living adjustment (COLA).

### **2. Service Entry between 1980 and 1986**

The Defense Authorization Act of 1981 changed the basis for calculating retiring military members' compensation. All members entering the service after August 1, 1981 were affected by this act. The plan, commonly referred to as 'HI 3,' lowers the retiree's entitlement by using the mathematical average of the member's highest 36 months of base pay as a basis for calculation vice just his/her final monthly base pay rate. The percentage multipliers and CPI protection afforded the member are identical to the final pay method previously defined. The result is a lower base pay number by which the applicable percentage is multiplied and thus less retirement compensation than under the final pay option.

### **3. Service Entry after 1986**

In enacting the Defense Authorization Act of 1986 Congress hoped to further reduce the cost of the military retirement system by lowering the compensation afforded retiring military members and at the same time mitigate the flood of military personnel leaving the services immediately following 20 years of service. This plan is commonly referred to as 'REDUX.' Here we see the manpower control aspect of the retirement system coming into play as both a tool for the services and a political scapegoat for the members of Congress. The act was intended to save money by reducing both the base pay multiplier and the COLA afforded the military retiree. These adjustments were made based on a belief that the existing system was too generous and that by making members serve longer to receive benefits equitable to their predecessors, less personnel would retire immediately following their twentieth year of service. It was thought that this would aid the military in combating retention problems, while at the same time saving the taxpayers money.

A retiree's pay under the REDUX plan is calculated by using the base pay method defined for the HI 3 plan but the percentage factors are lowered. Instead of receiving 50% of the base amount at 20 years of service a member is now entitled to only 40%. The per year percentage increase for each year past 20 years of service increased to 3.5% vice 2.5% thus members still reach the cap of 75% at 30 years of service. The benefits are further reduced by the cost of living adjustments annually applied being based on the CPI-1% vice just the CPI. There is an allowance for a one time 'catch-up' at age 62 but following age 62 the benefits again grow at the CPI-1% rate vice the full CPI protection afforded retirees under previous plans.

#### ***a. The Effects of the Defense Authorization Act of 2000***

The Defense Authorization Act of 2000 took steps to repeal/offset some of the reductions in retirement entitlements made by the 1986 act. The 2000 act gives members who originally entered the military service under the REDUX plan two options with respect to retirement entitlements. The member must elect at the 15 years of service point which plan he/she will participate. The first option is to revert back to the HI 3 plan

and receive the same benefits as personnel entering in the 1980 to 1986 timeframe. The second option is to take a one time \$30,000 career status bonus payment, obligate to stay on active duty until at least the 20 years of service (YOS) point has been reached, and subsequent to retiring have his/her entitlements calculated as outlined under the REDUX plan. Thus no personnel actually retired under the REDUX plan alone. The future economic value of the HI 3 and REDUX plan with career status bonus is a matter of much discussion. Table 1 presents the retirement benefits afforded a member retiring on December 31, 2002 under each program for the purpose of illustrating the diminishing value of the benefits of the military retirement system in recent years. The \$30,000 career status bonus is not included in the table as placing a value on the bonus requires many assumptions and can take many forms. The value of the bonus and thus total retirement entitlements under the REDUX with Career Status Bonus plan will be calculated using the model presented later in the thesis. The value of the Thrift Savings Plan (TSP) is not included in this table as its value is the same regardless of the retirement plan an individual is under. A further discussion of the TSP and the related benefits follows the table.

Table 1. Comparison of Retirement System Benefits Under the Three Plans Covering Today's Service Members (After: Ref. 1, 7, & 14)

	RANK & YOS	BASE PAY					
		2000	2001	2002			
	E-7 & 20	\$ 31,559	\$ 33,106	\$ 36,688			
	E-8 & 30	\$ 41,704	\$ 43,351	\$ 47,254			
	O-5 & 20	\$ 66,688	\$ 69,484	\$ 72,958			
	O-6 & 30	\$ 84,388	\$ 87,718	\$ 92,102			

RANK & YOS	2003 PAY			% REDUCED BY CHANGE		
	FINAL PAY	HI 3	REDUX	FINAL PAY	HI 3	REDUX
E-7 & 20	\$ 18,344	\$ 16,892	\$ 13,514	0%	7.9%	26.3%
E-8 & 30	\$ 35,440	\$ 33,077	\$ 33,077	0%	6.7%	6.7%
O-5 & 20	\$ 36,479	\$ 34,855	\$ 27,884	0%	4.5%	23.6%
O-6 & 30	\$ 69,077	\$ 66,052	\$ 66,052	0%	4.4%	4.4%

RANK & YOS	2013 PAY			% REDUCED BY CHANGE		
	FINAL PAY	HI 3	REDUX	FINAL PAY	HI 3	REDUX
E-7 & 20	\$ 24,653	\$ 22,702	\$ 16,473	0%	7.9%	33.2%
E-8 & 30	\$ 47,629	\$ 44,453	\$ 40,321	0%	6.7%	15.3%
O-5 & 20	\$ 49,024	\$ 46,842	\$ 33,990	0%	4.5%	30.7%
O-6 & 30	\$ 92,833	\$ 88,768	\$ 80,517	0%	4.4%	13.3%

#### **4. The Thrift Savings Plan**

The Defense Authorization Act for 2000 further enhanced the overall economic value of the military retirement package available to current and future service members by authorizing participation in the Uniformed Services Thrift Savings Plan (USTSP). The USTSP is modeled after the Thrift Savings Plan (TSP) that was authorized for federal employees in 1986. The TSP is the federal employee's equivalent to a civilian sector employee's 401K plan. In 2002 members can contribute up to 7% of base pay and various other forms of entitlement pays, tax-deferred, into the TSP. The money then grows tax-deferred until the member withdraws the money for use in retirement. The money is then taxed at the individual's current tax rate, which is typically lower than the tax rate applicable when the monies were initially earned. The limit on how much money a military member can contribute is controlled by federal statute as dictated in Internal Revenue Code sections 402g and 415 similar to civilian plans. Unlike most civilian 401k plans and the TSP for civilian employees under the Federal Employee Retirement System (FERS), the USTSP does not currently offer any matching funds to provide further incentive for the military member to participate. While matching funds are not currently paid to any military members, it is worthy of note that the act authorizing the USTSP does allow for matching funds to be utilized as a manpower tool. The use of matching funds for manpower control issues is at the discretion of the service secretaries. Placing an economic value on the USTSP for the typical retiree is a complex matter as a result of the many assumptions that must be made regarding market performance, degree of participation, and member's tax bracket information to name just a few. The model developed in Chapter V incorporates these factors and may be used in placing an overall economic value on the plan.

#### **5. The Military Retirement Fund**

The Defense Authorization Act of 1984 changed the accounting practices utilized by the DoD in managing the military retirement system. The effect of this was to go from a pay-as-you-go type system to one where the DoD was required to recognize, and subsequently budget for, future retirement costs when members initially join the service

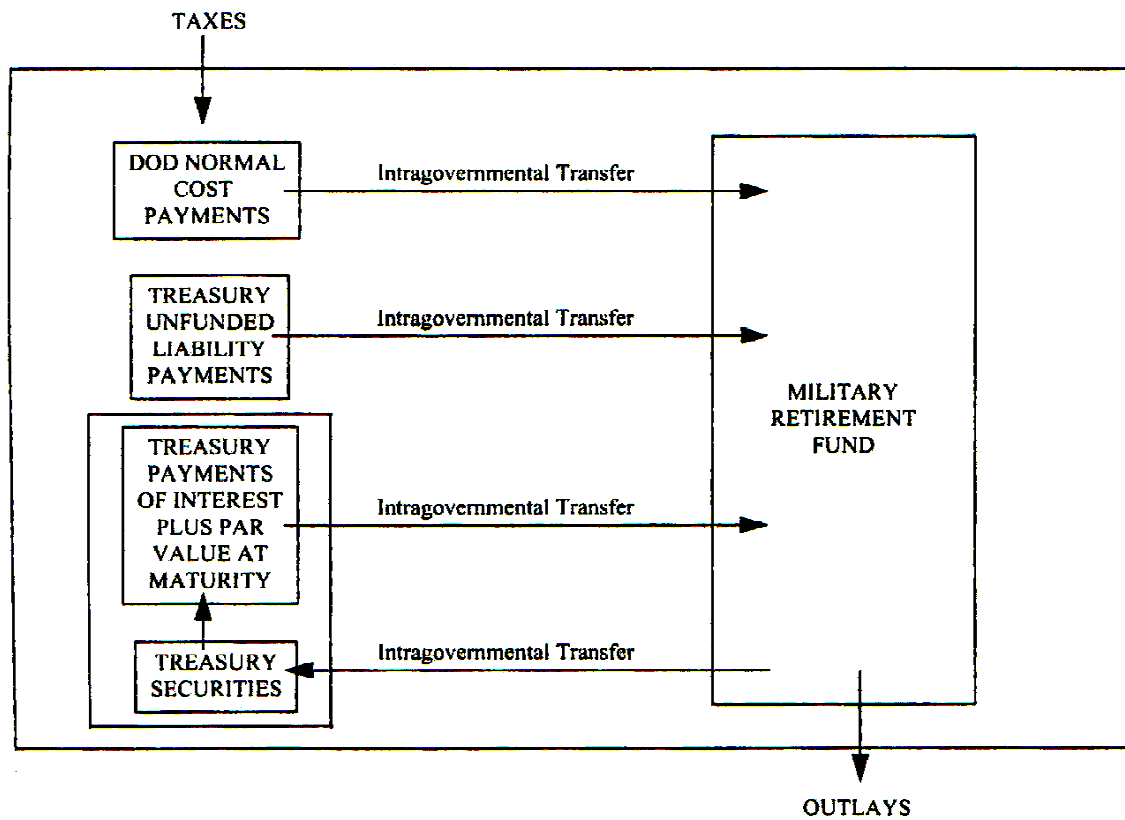
vice waiting until members actually retire. The balance and unfunded liability aspects of the Military Retirement Fund (MRF) made it much easier for people to readily determine the cost and financial status of the military retirement system. A result of the MRF making it easier for anyone to relatively quickly and simply evaluate the cost of the retirement system has resulted in even more legislative attention being given to trying to lessen these costs.

The MRF was officially established on October 1, 1984, as a result of public law 98-94, amended Title 10, United States Code (U.S.C.). Chapter 74 outlined the MRF as follows:

There is established on the books of the Treasury a fund to be known as the Department of Defense Military Retirement Fund (Hereafter in this chapter referred to as the 'Fund'), which shall be administered by the secretary of Treasury. The Fund shall be used for the accumulation of funds in order to finance on an actuarially sound basis, liabilities of the Department of Defense under military retirement and survivor benefits programs (Ref. 4).

When the MRF was established it was actuarially determined to have an unfunded liability in the amount of \$528.7 billion. The unfunded liability was the result of no funds having been earmarked to pay for the retirement entitlements of currently serving active duty members and members that had already retired. By design this unfounded liability would be paid by the Treasury department and amortized over the next 60 years. Thus from then forward the Treasury has made annual payments to the fund to pay for the unfounded liability. The DoD is responsible for actuarially determining the potential liability of each new years future retirement obligations and depositing on a monthly basis a portion such that this liability is fully funded each year. The only other inflow to the fund is that from interest and par payments on the balance of the fund that is invested in securities. Since its inception, the fund's only true outlays have been those of meeting the retirement obligations owed retirees and/or their survivors. The fund invests in U.S. Treasury securities for investment purposes. Figure 1 depicts the transaction cycle process for the MRF.

Figure 1. The Military Retirement Fund Transaction Process (From: Ref 1, p. 26)



#### D. ANALYSIS OF CURRENT PLANS VERSUS SYSTEM DESIGN OBJECTIVES

##### 1. Providing for the Economic Needs of the Retired

There is little debate, regardless of which of the three retirement plans a service member falls under, that the entitlements afforded the military retiree are sufficient compensation to meet the retiree's economic needs as compared with those benefits offered comparable employees under a civilian or federal civil service retirement system. The argument with respect to this objective is the failure of any entitlements for personnel completing less than twenty years of service. Unlike most civilian retirement systems, which vest employees at a maximum of 5-7 years of employment, the current plans available to military service members do not 'vest' the employee until at least twenty years of service have been completed. This inequity has always been a topic of much discussion. Movements to lessen the period of time required to receive retirement

benefits have routinely been thwarted by both the military services and Congress, arguing that earlier vesting would undermine the services retention efforts and simultaneously increase retirement system costs.

## **2. Maintaining a Young and Vigorous Force Structure**

All current military retirement system plans require at least twenty years of service for a member to be entitled to retirement benefits. A study conducted by RAND, *A Theory of Military Compensation and Personnel Policy*, found that while the existing system provided strong effort and retention incentive to mid-career personnel, it tended to reduce promotion opportunities for junior personnel and reduced effort incentive to those having exceeded the twenty or more years of service milestone. (Ref, 5 p. 120) This points out that while the retirement system aids in mid-career retention efforts it can actually be viewed as an obstacle in efforts to gain and retain new accessions, thus defeating much of the intent of the overall objective. A second shortcoming is that personnel past the twenty-year milestone are not provided as much incentive to excel as prior to that point. As is illustrated by the commonly used phraseology of a member being on the 'ROAD' (retired on active duty) program. It is also apparent that when retirement benefits were reduced in 1980 and again in 1986 that the reduced benefit packages had a significant impact on the Services' ability to maintain the desired force structure.

## **3. Maintaining a Pool of Readily Available Personnel**

The system, as currently designed, meets the requirement of maintaining a pool of readily available personnel. All personnel that retire from military service today and receive entitlements are eligible for recall to active duty. As this thesis is formulated on the basis that we will not change the existing objectives defined in Chapter II, all systems evaluated and/or developed by this study also encompass the associated costs and benefits of meeting this objective.

#### **4. Is it a Reasonable Cost to Society**

What does a reasonable military retirement system cost? There is no hard and fast number that one can place their finger on and say this is the value of a military retiree for his/her service to the country. This fact makes what is a reasonable cost for the military retirement system one of much contention. When times are good the cost is often ignored, but when the economy slows or deficit spending looms, any cost that cannot be fully justified is subject to reduction. This happened to the military retirement system benefits in 1980 and again in 1986. In the late nineteen nineties, when the national budget was operating at or near a surplus, the services were able to restore some of the military retirement system entitlements lost earlier by pleading the case that retention was being hindered to the point that the military was in danger of not being able to meet future readiness demands. As the shift of nearly all civilian corporations to defined contribution vice defined benefit type retirement systems continues it will continue to get harder to justify the expense of the military's defined benefit system to the American taxpayer. Thus while an exact number does not exist for comparison a cheaper system will always have an advantage over one costing more. Unless the military can show that the cost of their retirement system is as low as possible while still affording retirees their deserved entitlements and simultaneously meeting the manpower control objectives of the Service's it will continue to be the brunt of much scrutiny.

#### **E. SUMMARY**

The military retirement system has existed in some form since 1855 and has evolved with the times. It has undergone numerous changes and modifications in attempts to meet the needs of the military and society. The system that exists today is well aligned with the objectives upon which it is based. As with any system, it does not perfectly meet all of the objectives but rather is a compromise that ideally maximizes the extent to which the overall intent of the objectives is achieved. This said, the cost of the system and the fact that the rest of society has transitioned from a defined benefit to a



defined contribution retirement system mentality forces one to consider whether or not it is time to change the military system to something more equitable with that of society as a whole.

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## **IV. REVIEW OF ALTERNATIVE RETIREMENT PLANS FOR CONSIDERATION**

### **A. INTRODUCTION**

Over the years, many changes, both major and minor in scale, have been offered to the DoD for consideration as improvements to the existing military retirement system. This chapter will discuss in detail some of these options offered for consideration and evaluate them against the stated objectives of the retirement system. The studies that will be considered are: The President's Commission on Military Compensation of 1978, The Grace Commission recommendations of 1984, The Fifth Quadrennial Review of Military Compensation Report of 1984, and The MFERS option offered by RAND in 1994. A review of recommendations for overall privatization of the system will also be considered. The chapter will consider some criticisms of the systems and reasons why it is believed that the DoD and/or Congress did not endorse and subsequently incorporate the recommended system or changes. This is done to lay the groundwork for development of the multi-option retirement system that is discussed in chapter V.

### **B. THE PRESIDENT'S COMMISSION ON MILITARY COMPENSATION**

President Jimmy Carter formed the President's Commission on Military Compensation in 1978 to evaluate and analyze the military compensation system as a whole for applicability to an all-volunteer military force. In the process of studying the compensation system the commission spent considerable time and effort evaluating the military's existing retirement system. The commission found the existing system of allowing personnel to retire after twenty years of service at half of basic pay was no longer a justifiable program. (Ref 9, p. 2) The basis for this finding was the growing cost of the retirement system.

As an alternative, the commission recommended establishing a three-part noncontributory retirement plan consisting of severance pay, a trust fund, and an old age annuity. The severance pay portion would be applicable only to members involuntarily separated after five or more years of service. The trust fund portion was aimed at

strengthening retention by use of deferred compensation for members having served 10 years or more and designed such that it could be used to ease service members' transition to civilian life. The third, and largest component, was the old-age annuity which offered the following features:

- Eligibility for a deferred annuity at age 55, 60, or 62 depending on years of service, starting at 10 years;
- Annuity levels similar to those earned in Federal Civil Service employment;
- Partial integration of social security benefits and annuities;
- Inflation protection;
- Health care, exchange, and commissary benefits for most annuitants; and
- Fully coordinated military and Civil Service retirement plans; no dual compensation.

The main, and nearly immediate criticism, of the commission's recommendation for the revised retirement system was that the plan was not designed to meet the objectives of the DoD's retirement system. Further criticism of the plan was based on the fact that offering retirement compensation to individuals having served less than twenty years of service increased system costs while concurrently hindering the services' retention abilities and their ability to encourage member separation at the desired point. Thus while the system would theoretically lower costs it would not meet the manpower control objectives desired of the military retirement system. The system was never acted upon by Congress and thus never went into effect.

### **C. GRACE COMMISSION PROPOSALS**

President Ronald Reagan formed the President's Private Sector Survey (PPSS) in 1984. The PPSS is more commonly referred to as the Grace Commission. The Grace Commission was tasked with reducing government costs and inefficiencies. As a part of their study the commission evaluated the military retirement system and made the following change recommendations:

1. Service members that complete 20 years of service would only receive full and unreduced annuities at age 62 unlike the existing system under which annuity payments commence upon retirement regardless of age.
2. The formula for calculating military retirement pay would use a reduced multiplier of 1.6 percent of the Basic Military Compensation (BMC). BMC is equivalent to basic pay, allowance for quarters, subsistence, and the tax advantages that arise from these allowances, which is about the equivalent of 2.1 percent of basic pay. Retirement pay would also be based on the average of the highest five years of pay vice 3 as it is now based.
3. The share of Social Security benefits attributable to service would reduce retirement pay.
4. COLAs for retirees would be reduced to the lower of the percentage of the CPI or the percentage change in BMC. After the retiree reaches his 62<sup>nd</sup> birthday and becomes eligible for Social Security, the COLA increase would be reduced to only one third of the CPI increase.
5. The Grace commission, like the earlier discussed President's Commission on Military Compensation, also included an annuity for members that served between ten and nineteen years of service. (Ref. 10 p. 35-36)

The result of the above changes would have greatly reduced both the cost of the retirement system and the benefits afforded future military retirees with the noted exception of personnel separating from service between the tenth and nineteenth year of service. Retirement benefits would have been reduced by anywhere from fifty to ninety percent depending on the rate and years of service of a given member at retirement. The proposal again failed to meet all of the objectives of the military retirement system in that it really looked almost solely at cutting costs. Thus while it made the cost of the military retirement system more 'reasonable' in accordance with the retirement system's objectives it was done at the expense of maintaining the desired force structure and manpower objectives. Once again the proposals were never acted upon by Congress and as such did not impact the military retirement system directly. The study did however again raise questions about the twenty-year vesting of the current system and bring more

attention to the perceived overly generous nature of the existing military retirement system.

#### **D. FIFTH QUADRENNIAL REVIEW OF MILITARY COMPENSATION**

Every four years the Department of Defense, Office of the Secretary of Defense is required to present to Congress a review of the principles and purposes of the military compensation system. (Ref. 8 p. I-1) The Fifth Quadrennial Review of Military Compensation (QRMC) was performed in 1983. The QRMC typically concentrates its efforts on specific areas. In 1983 the QRMC performed an exhaustive study of the military retirement system. In doing so the recommendations of both the President's Commission on Military Compensation and the Grace Commission's recommendations with regard to the military retirement system were addressed. The tasking of the Fifth QRMC was as follows:

The specific tasking for the 1983 Fifth Quadrennial Review of Military Compensation (QRMC) was to review the Uniformed Services retirement system, with its associated benefits, and the Special and Incentive pay system. This review was structured around the following question: To what extent do the existing systems contribute to our national defense? The tasking stated, "To the extent that they contribute, they should be preserved and strengthened. To the extent that they do not, they should be restructured or else be eliminated." (Ref 8, p I-1)

The Fifth QRMC study resulted in over thirty major findings about the military retirement system and nineteen recommendations for consideration. The QRMC also developed four primary alternatives for restructuring the existing military retirement system. The alternative plans each consisted of reducing the base multiplier or COLA coupled with early withdrawal facets. The plans were based, as one would expect from the tasking, on strengthening the manpower control aspects of the existing retirement system. Thus while the study and subsequent recommendations were informative, they failed at the objective of reducing retirement system costs to a more reasonable level. The plans basically reallocated the costs in such a manner as to strengthen the manpower control facets of the system without looking for potential cost savings. The study was critical of both the President's Commission on Military Compensation and the Grace

Commission findings as being driven by the goal of achieving cost reductions without regard for the potential effects the cuts would have on national security. The QRMC also found there to be no merit in the concept of a shorter or longer vesting period than currently existed. The study asserted that shorter-term vesting served only the interest of those individuals who separated from the service prior to the twenty-year point. Thus weakening the manpower control aspects of the system while increasing its cost. Interestingly the study also found that lengthening the vesting period to more than twenty years would lessen the effectiveness of the system as a manpower control tool. As with the earlier studies the recommendations were acknowledged but not directly implemented. Thus the three studies reviewed so far have offered plans to either reduce the system costs or increase the manpower and force structure aspects of the retirement system, but all have failed at properly balancing the needs of all of the system objectives.

The Defense Authorization Act of 1986, which implemented the REDUX plan discussed in Chapter III, seems to have been a result of a combination of the three studies discussed. The REDUX plan resulted in reduce government cost by reducing the benefits afforded the military retiree, both in original entitlements and future COLAs. The REDUX plan also provided added incentive to members to continue to serve after reaching the twenty-year point by increasing the additional retirement benefits earned for each additional year served. As is evidenced by the effective repeal of these changes by the Defense Authorization Act of 2000, insufficient study was done prior to adopting these changes to the military retirement system.

## **E. RAND RECOMMENDATION FOR MILITARY RETIREMENT SYSTEM**

### **1. Introduction**

RAND's National Defense Research Institute is a federally funded research and development center sponsored in part by the Office of the Secretary of Defense. In 1994, the institute undertook a study of the military retirement system and possible alternative systems. *Reforming The Military Retirement System*, published by RAND in 1998 is an analysis and extension of the findings of the earlier studies. The study looked at both the

cost and manpower control aspects of the retirement system and attempted to model a single replacement system as a better alternative to meeting the objectives of the military retirement system. The Military Federal Employee Retirement System (MFERS) was developed at a time when REDUX was the existing military retirement plan. As a result, the manpower control and cost aspects of the MFERS were compared to those the military expected to see if REDUX continued unchanged. As discussed in Chapter III, the original REDUX retirement plan has subsequently been supplemented by way of both the \$30,000 career status bonus and the availability of the TSP. This chapter presents the MFERS plan as developed and includes an analysis of the effects that changes to the REDUX system have had on its findings and applicability.

## **2. MFERS as Presented by RAND in 1997**

The MFERS, based on the Federal Employee Retirement System (FERS) consists of three separate retirement portions coupled with a seven percent across the board base pay raise. The three parts of the MFERS system are: (1) Social Security Benefits, (2) A defined benefit plan, and (3) A defined contribution plan.

### ***a. The Social Security Portion***

The Social Security portion of the MFERS recommendation is similar in nature to the existing military retirement system. One difference though is that under the MFERS, the Social Security benefits afforded a service member are estimated and included in computing the total value of his/her retirement system. Under the current military retirement system the Social Security benefits of the member are considered separately from one's military retirement entitlements. Another difference is that as MFERS was coupled with a one-time seven percent base pay raise, the system would result in increased Social Security taxation to the member, and in theory, greater final benefit entitlements from the Social Security Administration. The changes in both the costs and benefits afforded the individual are relatively minor. Thus the only significant point here is the inclusion of these benefits in the overall value of the military retirement package.



***b. The Defined Benefit Portion***

The defined benefit portion of the plan is referred to as the 'Basic Benefit Plan.' The plan would incorporate vesting after a period of five years. The plan would require service members to contribute approximately seven percent of base pay to the defined benefit portion of his/her retirement entitlements. This is a large part of the reasoning behind implementation of the system being coupled with an initial one-time seven percent across the board pay raise. The defined benefit is calculated by taking into account a member's age and number of years of service at the time of retirement. Eligibility for retirement would also be a combination of the member's age and years of service. The youngest age a member would be eligible for retirement benefits under the MFERS system is 55, requiring at least 30 years of service. Conversely a member can retire at age 62 with benefits, having served for as few as five years. An individual's entitlement is found by multiplying his/her years of service times the highest three-year average pay times either one or one-point-one percent depending on the retiree's age and years of service. The one-point-one percent multiplier is applicable only to those with at least twenty years of service and 62 years old. The plan also accounted for COLA as follows, if CPI was less than or equal to two percent the COLA was CPI, two percent COLA if CPI was between two and three percent and CPI-1 if the CPI was greater than three percent. The plan left additional benefits such as medical, commissary, and exchange service available to those retiring with greater than twenty years of service.

***c. Defined Contribution Portion***

The third and final part of the MFERS is the defined contribution portion. The defined contribution portion was modeled after the TSP that was offered Federal employees of the time. The TSP portion of MFERS was very similar to the USTSP discussed in Chapter III. Some basic differences of the TSP portion of MFERS and the USTSP were as follows. The government would automatically match one percent of a service member's base pay. The military member would be vested in the TSP after only three years of service. The government would also match up to five percent of an

individual's base pay contributions. Any monies contributed by the member would be immediately vested along with earnings on these investments.

### **3. Summary of MFERS Option**

The original models developed for consideration of the MFERS option were designed in 1994. By 1997, RAND was modifying the basic MFERS recommendation by way of adding an additional skewed type base pay raise and/or use of incentive bonuses to make the plan more equitable to the objectives of the military retirement system. This was necessary because as originally offered the MFERS resulted in significantly reduced benefits to military retirees and at the same time the cost savings of the plan were the subject of much discussion as they were heavily dependent upon the real discount rate assumed in making the calculations. The system also had manpower control issues such as allowing for early vesting options and the lack of a way to provide the necessary incentive for personnel to retire before age 62. While the system received much attention and consideration, it has not yet been fully endorsed by DoD or acted upon by Congress.

### **4. Effects of REDUX Plan Enhancements**

The Defense Authorization Act of 2000 had a significant impact on the findings by RAND. As discussed earlier, the MFERS option was based on the cost, manpower control tools, and retiree benefits afforded the military by the REDUX retirement plan. Initial Pentagon data reveal that only about seventeen percent of individuals that have had the opportunity to elect to take the \$30,000 career status bonus and remain under the REDUX retirement plan have done so. (Ref 12 p. 16) While these are just initial data and not yet statistically relevant, they are indicative of the weighting personnel give retirement plan considerations. Regardless of which plan, HI 3 or REDUX with career status bonus, a member elects, the cost to the DoD and benefits afforded the retiree are substantially different from those used by RAND when developing and analyzing their system. Thus further analysis would be required to reach meaningful conclusions about the plans appropriateness today.

## **F. COMPLETE PRIVATIZATION OF THE MILITARY RETIREMENT SYSTEM**

Over the years consideration has been given to privatizing the entire military retirement system. There are currently a multitude of A76 studies looking at the government outsourcing of any function that can be better or more cheaply done by the private sector. The military retirement system is one such system that could theoretically be outsourced. Regardless of whether or not the system is outsourced, the structure of the retirement system with respect to the benefits and costs would still have to be developed and accepted in accordance with the DoD retirement system's stated objectives. Cost savings may be realizable by fully outsourcing the administration of the military retirement system, analysis of these potential savings is beyond the scope of this study.

## **G. SUMMARY OF RECOMMENDED CHANGES**

A review of the recommended changes to the military retirement system discussed here makes apparent the complexity and enormity of the tasking placed on the system. As was illustrated, it is relatively easy to design a system to lower costs, or structure a system to better enable manpower control. It is significantly more difficult to develop a single system that achieves both aspects. The political aspects of the military retirement system serve to make designing the system an even more arduous tasking. As was apparent in the discussion of the MFERS system, even systems designed and tested using empirical and theoretical models to prove their merit are not guaranteed to displace the existing system. Yet another testimony to the steadfastness of the military retirement system is the Defense Authorization Act of 2000 effectively overriding the cost reductions brought about by the 1986 act. With all this considered, Chapter V will offer yet another solution to the question of how to achieve cost savings without losing the ability to control force structure.

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## **V. DEVELOPMENT OF A MULTI-OPTION RETIREMENT SYSTEM FOR DOD**

### **A. INTRODUCTION**

The premise on which this chapter is based is the development of a retirement system for the DoD that maintains, if not enhances, the manpower control aspects of the current retirement system but can be implemented at a substantially reduced cost to the taxpayer. As was discussed earlier in the study, the cost of the current system is the main reason it has been receiving so much attention in recent years. It follows from this concept then that a system that can accomplish the same or provide enhanced benefits for a reduced cost would be in the best interests of both the DoD and service members. Any time the retirement system is debated/changed by Congress there is an immediate and apparent effect on service members' morale and subsequently the services' accession and retention abilities. Another aspect of the system that must be considered is the detrimental effect that the lower benefit level afforded by the adoption of the REDUX plan had on manpower control and retention. Consideration must also be given to adopting a plan that is comparable to what is commonly accepted by the majority of society. The existing defined benefit plan, based solely on years of service and highest 36-months of base pay which vests members only after 20-years of service, is neither consistent with nor easily comparable to most civilian employee retirement plans. The movement of most civilian industry to defined contribution type retirement plans that are flexible and portable signals the need for the DoD to follow suit if it wants to stay competitive for the best possible future military entrants.

As was discussed above, any retirement system that is to receive serious consideration for acceptance by the DoD must have several key elements. While low cost is important to the DoD for many reasons, the ability to maintain force structure and required end strength is not negotiable. The first and probably most important of these elements is that the benefits, as perceived by the service member, must be at least equal to or greater than those of the old system or there will be immediate detrimental effects on force structure and retention efforts as was experienced following the adoption of REDUX. A second element for consideration is the manpower control tools that are

required by the objectives of the system. There is little argument that the existing '20 or nothing' concept, while outdated, is a large motivator and tool for mid-career service member retention. Consideration must also be given to how to entice members to leave the service voluntarily when their staying is no longer in the best interest of the military. Another key element of the system is its desirability to potential military entrants. With these key elements taken into consideration the following proposed retirement system is offered for consideration. The cost and benefit values presented in this chapter will be based on a deterministic type model. Chapter VI will then present a stochastic model approach to allow for a more accurate comparison of the existing plan and the newly proposed option. All calculations are based on year 2000 DoD data and historical inflationary and TSP investment return data.

## **B. A MULTI-OPTION RETIREMENT SYSTEM FOR THE DOD**

To better meet the needs of the DoD while simultaneously lowering system costs the proposed system will offer future military entrants three retirement system options upon entry into the service. The three options are, (1) the existing HI 3 plan, (2) the REDUX plan coupled with a modified Career Status bonus, and (3) the newly developed TSP Only option which will be defined in this chapter.

### **1. HI 3 Option**

The first option available to future military members would be to opt for the HI 3 retirement system plan that currently exists. The plan pays a lifetime annuity commencing immediately upon retirement to individuals who serve for at least twenty years. The value of the annuity is based upon a percentage of the average of the member's highest 36 months of base pay. The plan also accounts for cost of COLA by increasing at an annual rate equal to the CPI. The percentage is found by multiplying a service member's number of years of service by 2.5% with a maximum rate of 75% being reached for thirty or more years of service.

## **2. REDUX + Career Status Bonus Option**

The second option offered to new military entrants would be the REDUX plan coupled with a \$30,000 Career Status Bonus at the fifteenth year of service point. The plan again pays a lifetime annuity commencing immediately upon retirement for members having served for at least twenty years. The COLA aspect of the plan is less desirable than in the HI 3 scenario in that it increases at a rate of CPI-1% vice the full CPI. There is a one-time catch-up feature at the age of 62 to offset some of the loss in cost of living increase benefits, but after age 62 the CPI-1% formula is again applied to future COLA. The annuity payments are based on a percentage of the member's highest 36-month period of base pay. The percentage of base pay factor starts at 40% for twenty years of service and then increases by 3.5% for each additional year of service again reaching a maximum at 75% for 30+years of service. The Career Status Bonus is a one-time \$30,000 bonus payment paid to the service member during his/her fifteenth year of service. The amount of the bonus will be increased at the same rate as base pay to maintain it as an equitable offset to the differences between the HI 3 plan benefits and the REDUX annuity benefits.

## **3. The TSP Only Option**

The final option available for selection by new military entrants would be the TSP Only option. This option consists of three basic money streams that will increase as base pay and years of service increase. The three sources of money are, a 5% of base pay mandatory member contribution, a 5% of base pay government matching contribution, and a varying percentage of base pay government incentive contribution. The money will be invested in the member's TSP account. The member and government matching contributions will vest immediately while the government furnished incentive contributions will vest in 5-year blocks based on the member completing the associated service period. The funds will be made available to the member immediately upon separation from the service. If the member has served for less than twenty years the funds would be portable or transferable to other retirement type accounts as is common in civilian industry. If the member separates/retires from the service with at least twenty

years of service the benefits will be immediately available for withdrawal without penalty. This facet of the TSP Only option requires a change in existing law to allow for penalty free withdrawals from the account prior to reaching age fifty-nine and a half. This change is necessary to maintain a similar degree of the equity between the benefits afforded retiree's under each option. Benefits such as commissary, exchange, and medical services would remain the same as under the current retirement system.

***a. Member Mandatory Contribution***

All members electing the TSP option would be required to make 5% of base pay contributions to the account for the duration of their time in service. As the TSP is a retirement investment vehicle, funds that are contributed are tax-deferred. Thus while the required contribution is 5% of base pay, the average military member pays federal income tax at a rate of approximately 16%, thus a member's take home pay would be lessened by only 4.2% on average. (Ref. 19 p. 72) Any funds contributed by the member are immediately vested.

***b. Government Matching Contribution***

The government would match the 5% of base pay contribution that the member makes for the duration of the member's time in service. These funds will again vest immediately.

***c. Government Incentive Contribution***

The government incentive contribution portion of the retirement plan is based on the DoD valuation of continued member service. The rates presented in table 2 show the percentages used for analysis of the plan and comparison against the other options. The percentages presented in table 2 are based on initial calculations of the option providing equal or greater monetary value to the member retiring after twenty years of service than the other two options. They do not take into account the added value of the intangibles, such as portability, flexibility, and growth potential, that should be considered when making the final implementation decision regarding incentive



contribution percentages. The percentage of base pay that the incentive contributions account for will vest only after the member completes the associated period of service. For comparison sake the DoD wide vesting period is assumed to be five years. Thus any incentive contributions earned in the five year period automatically vest upon completion of that five year period and another five year vesting period with respect to incentive contributions begins.

Table 2. Summary of Retirement Plan Option Benefit Calculations

Option	Benefit Calculation/Contribution percent	
HI 3	$2.5 \times \text{YOS} / 100 \times (\text{Average of highest 36 months of base pay})$	
REDUX	$(0.4 + (\text{YOS} - 20) \times 3.5 / 100) \times (\text{Average of highest 36 months of base pay})$ + \$30,000 Career Status Bonus at 15 YOS point	
TSP	<b>Member contribution</b> 5% <b>Government matching contribution</b> 5% <b>Government Incentive contribution:</b>	
	YOS	
	1 to 5	5%
	6 to 10	15%
	11 to 15	20%
	16 to 20	25%
	21 to 25	15%
	26 and up	10%

## C. DETERMINISTIC COST AND BENEFIT ANALYSIS

### 1. Introduction

The costs and benefits of any retirement system can be found in numerous ways. A relatively common and simple approach is the use of a deterministic type analysis. The basic idea behind this type of approach is to utilize existing historical data for model input. The results from a deterministic analysis are point estimates. In the case of the retirement system options, the costs and benefits can be found in this manner to allow for initial comparison of the three options that would be offered to future military entrants.

## 2. Assumptions

To analyze the costs and benefits associated with the various retirement system options some assumptions had to be made. To fully understand the output results from any model one must first understand the assumptions and limitations that went into the design of the model. The following list details the major assumptions made when calculating the various option costs and benefits.

- The use of year 2000 data is representative of the average DoD manpower force structure, end-strength, base pay, and continuation rate data. Detailed data can be reviewed in appendix A.
- The typical career progression tables remain similar to those found in appendix B.
- The historical rates of return on the TSP funds and inflation rates are representative of what future returns will be and can be found in appendix C.
- Necessary policy and statute changes would be enacted concurrently with adoption of the new retirement system such that limitations such as maximum contribution limits for TSP accounts would not be violated by the system.
- Personnel retiring from military service with at least 20 years of service will be of the same proportions as the retirement system option selection proportions.
- Assets invested in the TSP will be allocated pre- and post-retirement in a manner similar to the allocations given in Table 3. This assumption is necessary for the user to fully understand how the future values of the TSP fund investments presented in this chapter were determined.

Table 3. Asset Allocation Assumption (After: Ref. 13)

<b>TSP Fund</b>	<b>Comparable Index/security</b>	<b>Pre-retirement percent of assets</b>	<b>Post-retirement percent of assets</b>
<b>G-fund</b>	Short-term Govt securities	5%	20%
<b>F-fund</b>	LehmanBrothers U.S. Aggregate index	10%	40%
<b>C-fund</b>	S & P 500 index	40%	25%
<b>S-fund</b>	Wilshire 4500 stock index	25%	5%
<b>I-fund</b>	EAFE index fund	20%	10%
<b>Total</b>		100%	100%

### 3. Cost Calculations

#### a. HI 3 Costs

The cost of the HI 3 option of the retirement system can be determined by using data provided in the *Valuation of the Military Retirement System* report produced by the Department of Defense Office of the Actuary. The report contains a ‘normal cost’ factor for the HI 3 retirement system. For the year 2000 the normal cost of the HI 3 system is 29.2% for non-disability retirement payments. (Ref 1, p. 11) The cost of the HI 3 portion of the retirement is then found by multiplying the normal cost by the applicable percentage of annual gross base pay. Table 4 contains total cost data for the HI 3 system.

Table 4. HI 3 Option System Total Costs

Normal Cost	Total Annual Base pay	Total System Costs
29.2% X	\$36,816,041,268 =	\$10,750,284,050
<b>NOTE:</b>		
1. Assumes 100% of personnel elect this option		
2. Based on year 2000 data		

#### b. REDUX + Career Status Bonus Costs

There are two separate calculations required to determine the cost of the REDUX + Career Status Bonus option. The first is similar to that done to find the cost of the HI 3 option. Again the normal cost has been calculated and published by the DoD. The normal cost of the REDUX system for year 2000 is 27.2%. (Ref 1, p. 11) The second calculation undertaken to determine the total cost of the option is the cost of the bonus. The cost is found by multiplying the number of personnel who will enter their fifteenth year of service by the amount of the bonus and percentage of personnel opting for the TSP Only option. Table 5 contains the total cost data for the REDUX + Career Status Bonus option.

Table 5. REDUX + Career Status Bonus Option Total Costs

Normal Cost	Total Annual Base Pay	Portion Costs	Total Cost
27.20%	\$36,816,041,268	\$10,013,963,225	
Bonus Amount	Number of Personnel Receiving		
\$30,000	22639	\$679,170,688	<b>\$10,693,133,913</b>
<b>Note:</b>			<b>Equivalent Normal</b>
1. Assumes 100% of personnel elect this option			<b>Cost</b>
2. Based on year 2000 data.			<b>29.04%</b>

*c. TSP Only Costs*

Determining the total cost of the TSP Only system requires finding the cost of the lost tax revenue, government matching contributions, and government incentive contributions. The cost of the lost tax revenue is found by multiplying 5% of the total annual base pay applicable to the option by 16%. 16% is used here as it is assumed to be the average federal income tax rate of military personnel today. The government feels the costs of the lost tax revenue. DoD pays for the government matching and incentive contributions costs. The government matching contribution cost is simply 5% of the options applicable gross base pay for the year. The third and final portion of the cost is that of the government incentive contributions. The cost of the incentive contributions is found by using personnel continuation rate data, incentive contribution percentages, and base pay data to calculate the total cost. Table 6 contains the total cost data for the TSP Only option.

*d. Lowest, Highest, and Nominal System Cost Analysis*

The multi-option aspect of the proposed retirement system allows for total retirement system costs to vary greatly depending on the proportion of service members selecting each option. While the author believes that most members would opt for the TSP Only option there is no guarantee of this. One would be remiss to not evaluate the lowest, highest, and nominal system costs based on potential options selection proportions. The lowest cost scenario is one in which all members select the TSP Only option as it has the lowest normal cost. The ‘normal cost’ of the TSP Only option is

found by dividing the options total cost into the annual gross base pay. This results in a normal cost of only 15.1% for year 2000 data as compared to 29.0% and 29.2% for the REDUX + Career Status Bonus and HI 3 options respectively. The highest cost scenario is one in which all personnel that reach at least 20 years of service selected the most expensive option, HI 3, while all other personnel opted for the TSP Only option. A nominal case in which 33% of personnel elect each plan and subsequently all members serving for at least 20 years being equally dispersed with respect to retirement option gives a more realistic total system cost estimate. Table 7 illustrates the cost under each of the three scenarios discussed.

Table 6. TSP Only Option Total Costs

Total TSP Only Option Costs Consist of Three Portions					Portion Cost	Total Cost
<b>1. Lost Tax Revenue Due to Deferral</b>						
Average Tax rate		% match		Base Pay		
16%	X	5%	X	\$36,816,041,268	<b>\$294,528,330</b>	
<b>2. Government Matching Contributions</b>						
		% Match		Base Pay		
		5%	X	\$36,816,041,268	<b>\$1,840,802,063</b>	
<b>3. Government Incentive Contributions</b>						
Officer	Calculations incorporate base pay and continuation rate data. The				<b>\$1,353,464,163</b>	
Enlisted	breakdown by years of service can be viewed in Appendices B and C				<b>\$2,064,228,683</b>	
						<b>\$5,553,023,240</b>
						<b>Equivalent Normal Cost</b>
						<b>15.08%</b>
<b>NOTE:</b>						
1. Assumes 100% of personnel elect this option						
2. Based on year 2000 data						

Table 7. Lowest, Highest, and Nominal Cost Analysis

<b>Lowest Cost</b>	all TSP Only option cost =	<b>\$5,553,023,240</b>	<b>Equivalent normal cost</b> <b>15.08%</b>
<b>Highest Cost</b>			
	HI 3 option	\$10,750,284,050	
	+		
	Rest TSP option=	\$4,351,254,352	
	Total	<b>\$15,101,538,402</b>	<b>41.02%</b>
<b>Nominal Cost (33% select each option)</b>			
	TSP Only	\$1,849,156,739	
	+		
	REDUX + Career Status Bonus	\$3,560,813,593	
	+		
	HI 3	\$3,583,069,674	
	Total Cost	<b>\$8,993,040,006</b>	<b>24.43%</b>

#### 4. Benefit Calculations

##### *a. HI 3 Benefits*

Retiree entitlements under the HI 3 option are based on the member's years of service at retirement and the average of the highest 36 months of base pay the member received. The percentage of average base pay that the retiree earns is dependent upon the number of years served. The percentage starts at 50% for twenty years of service completed and increases by 2.5% for each additional year until reaching a maximum of 75% at the 30 years of service point. The benefits are adjusted for cost of living increases by being increased annually at a rate equal to the CPI for the year. The retiree's annuity is a perpetual type annuity in that payments are received for the remainder of the retiree's lifetime. Tables 8-11 summarize the option benefits for selected retirees to allow for comparison of benefits afforded the retiree under each option available.

##### *b. REDUX + Career Status Bonus Benefits*

The benefits afforded a retiree under the REDUX + Career Status Bonus option consists of two money streams. The first money stream is a perpetual annuity

similar in calculation to the HI 3 plan annuity. The value of the two annuities differs in the percentage of the average base pay and in the adjustments to account for annual increases in cost of living. The annuity percentage factor starts at 40% for twenty years of service, vice the 50% used in the HI 3 calculation, and increases by 3.5% per year to again reach a maximum of 75% for thirty years of service. The annual cost of living adjustments are computed by using CPI-1% instead of full CPI. There is a one-time catch up at age 62, after which the annuity again increases at a reduced rate. The second money stream is the value of the career status bonus. To find the maximum benefit value of the option one assumes that the bonus is invested in the TSP and earmarked for use as retirement funds. To determine the value of the bonus at retirement age one needs to assume both a rate of return on the investment and rate of inflation for the years between receipt of bonus and retirement. For the purposes of determining a point estimate the rate of return used will be a typical asset allocation among the TSP funds for a pre-retirement individual. The asset allocation will be in accordance with the data given in the earlier assumptions. The rate of return will be calculated by finding the weighted average return rate for the various funds in the TSP. The historical average return rate and annual return rate data for each of the available TSP funds can be reviewed in Appendix C. The historical average inflation rate and supporting data can be found in Appendix E. Tables 8-11 contain selected retiree benefit calculations.

*c. TSP Only Benefits*

The TSP Only option retiree benefits differ markedly from the first two options in that there is no guaranteed perpetual annuity portion and subsequently no cost of living adjustments. The benefits afforded the retiree are simply the contributions that both the retiree and the government made during his/her years of service. To find the retiree's benefits one must calculate the value of the TSP contributions plus accumulated returns for the period that the individual served in the military. The funds are invested in TSP funds in an asset allocation similar to that assumed in defining the model. To find a point estimate of the final value one must again use a weighted average rate of return for the given asset allocation. For the purpose of comparison, actual pay, inflation rates, and rates of return on like investments from 1970 to 2000 have been used to compute what a

retiree's benefits would have been had he/she selected the TSP Only option upon entering the service. Tables 8-11 contain selected retiree benefit calculations for the purpose of comparing each of the options.

Table 8. Retirement Entitlements of an O-7 Retiring in Year 2000 After 30 Years of Service Under Each Retirement Option

<b>HI 3 option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
75%	\$7,653		<b>\$68,880</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
75%	\$7,653		\$68,880
plus			
CSB Value	Real Return Rate		
\$195,542	8.67%		\$17,217
		<b>Total</b>	<b>\$86,097</b>
<b>TSP ONLY option retirement entitlements</b>			<b>Initial Annual Annuity</b>
TSP Lump Sum	Real Return Rate		
\$1,024,372	8.67%		<b>\$92,096</b>
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			



Table 9. Retirement Entitlements of an E-9 Retiring in Year 2000 After 30 Years of Service Under Each Retirement Option

<b>HI 3 option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
75%	\$3,727		<b>\$33,540</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
75%	\$3,727		\$33,540
plus	CSB Value	Real Return Rate	
	\$195,542	8.67%	\$17,217
		Total	<b>\$50,757</b>
<b>TSP ONLY option retirement entitlements</b>			<b>Initial Annual Annuity</b>
TSP Lump Sum	Real Return Rate		
\$529,035	8.67%		<b>\$47,563</b>
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			

#### **D. ALIGNMENT WITH DOD RETIREMENT SYSTEM OBJECTIVES**

##### **1. Providing for the Economic Needs of the Retired**

The future economic need of the military retiree is sufficiently met by any of the three options offered under the multi-option retirement system proposed. While the make-up and total value of the benefits afforded the retiree vary from option to option all three options result in benefits that meet the needs of both the retiree and society as a whole. All three options provide benefits that far exceed the average civilian employee retirement system benefit. The multi-option system also has the benefit of being more

Table 10. Retirement Entitlements of an O-5 Retiring in Year 2000 After 20 Years of Service Under Each Retirement Option

<b>HI 3 option retirement entitlements</b>			<b>Initial Annual Annuity</b>
	Years of Service Factor	average of 36 highest months base pay	
	50%	\$5,208	<b>\$31,246</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			<b>Initial Annual Annuity</b>
	Years of Service Factor	average of 36 highest months base pay	
	40%	\$5,208	\$24,997
plus	CSB Value	Real Return Rate	
	\$71,060	8.67%	\$6,257
		Total	<b>\$31,254</b>
<b>TSP ONLY option retirement entitlements</b>			<b>Initial Annual Annuity</b>
	TSP Lump Sum	Real Return Rate	
	\$451,450	8.67%	<b>\$39,750</b>
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			

easily understood and compared to civilian plans thus allowing potential future military members to make a more informed decision as to whether the military is right for him/her or not. The fact that all service members selecting the TSP Only option would see their retirement benefits amassing in accounts in their own names and the ability to separate from service at any point and take some of the retirement benefits with them would provide a strong incentive for new entrants to select this option. An analysis of the benefits also reveals that there are in some cases larger annuity payments provided

Table 11. Retirement Entitlements of an E-8 Retiring in Year 2000 After 20 Years of Service Under Each Retirement Option

<b>HI 3 option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
50%	\$2,793		<b>\$16,756</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			<b>Initial Annual Annuity</b>
Years of Service Factor	average of 36 highest months base pay		
40%	\$2,793		\$13,405
plus	CSB Value	Real Return Rate	
	\$71,060	8.67%	\$6,257
		Total	<b>\$19,662</b>
<b>TSP ONLY option retirement entitlements</b>			<b>Initial Annual Annuity</b>
TSP Lump Sum	Real Return Rate		
\$234,046	8.67%		<b>\$20,608</b>
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			

by selecting the TSP Only option. The multi-option retirement system is therefore very well aligned with the objective of providing for the future economic needs of military retirees.

## 2. Allowance for Maintaining a Young and Vigorous Force Structure

The multi-option retirement system would allow for maintaining a young and vigorous force structure. First and foremost is acceptance of the fact that the existing

system does an acceptable job of meeting this objective. The multi-option system leaves this intact and gives the DoD the ability to adjust incentive contribution percentages to even better control the incentive provided to service members to separate at the appropriate time from a DoD perspective. Thus implementation of the multi-option system meets the overall DoD retirement system objective of allowing for maintaining a young and vigorous force structure.

### **3. Maintenance of a Pool of Readily Available Personnel**

By requiring all personnel that serve their country for at least 20 years of service to be available for recall, as is the case now, the objective of maintaining a pool of readily available personnel is met. Changing the retirement system structure from its existing make-up to the multi-option structure recommended does not reduce the systems ability to meet this objective. All personnel serving for twenty or more years and enjoying the added benefits afforded them as a result would still be in the pool of readily available personnel.

### **4. Reasonable Cost to Society**

As was discussed earlier, there is no hard number of what cost is reasonable for the DoD military retirement system. The lower the cost the better seems to be the accepted standard. The multi-option system, as proposed, has great potential to better meet this objective by resulting in lower over-all system costs. The cost of the system is dependent on the participation rates in each of the options. As was shown in Table 7, even under the nominal option participation scenario of one-third of service members opting for each plan, the normal cost of the system is reduced from its current rate of nearly 29% to only 24%. This 5% reduction in normal cost would have resulted in savings of approximately two billion dollars in year 2000 retirement system costs. The author believes the participation in the TSP Only option would far exceed the nominal scenario presented and thus result in even greater savings.

## **E. SUMMARY**

The proposed multi-option retirement system for DoD has many positive traits. The improvements over the existing program range from greater manpower control and lower cost from the prospective of the DoD to enhanced flexibility, portability, and comparability on the part of the military member. The plan, even with the overly generous incentive contribution percentages, reduces the estimated military retirement system costs by at least 50%. The flexibility, portability, and comparability aspects of the system coupled with the fact that the TSP Only option does away with the twenty or nothing facet of the current system make the multi-option system proposed much more appealing to today's potential military entrants. This should aid the military services in attaining accession goals. These traits make the system a better overall retirement system option for consideration by the DoD. As was discussed, the plan more completely fulfills the requirements of the DoD retirement system objectives. The retiree benefits presented in this chapter are point estimates based on historical data. Chapter VI develops a stochastic approach to calculating the benefits of the REDUX + Career Status Bonus and TSP Only options. This will allow the potential future military member to more accurately predict the future economic value of a given retirement system option and thus make his/her decision based on more accurate data. The model will also allow the DoD to more accurately evaluate the differences in benefits afforded the military retiree for use when deciding on factors such as future incentive contribution percentages. Lastly the model allows the user to change selected inputs and analyze the results the change has on retirement system costs and benefits. This facet allows the DoD the ability to predict what future retirement system costs will be.

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## **VI. SIMULATION MODEL DEVELOPMENT AND IMPLEMENTATION**

### **A. INTRODUCTION**

The use of Monte Carlo type simulation models to more accurately estimate the costs and benefits of potential ventures is widely used in business today. “The Monte Carlo method is fast becoming one of the most popular tools in the financial-planning field,” according to a recent Wall Street Journal article. (Ref 18) The output of the model is a range of possible outcomes. The probability of a given outcome is also given. Thus the model provides not only what the best and worst case scenarios are but also the probability of either one occurring. Armed with these data vice a simple point estimate the model user can make a better-informed decision and thus increase the chance of reaching his/her desired goal. This type of simulation model lends itself to use in estimating the future returns and subsequently the total value of a money stream. For this reason, it is applicable to the analysis of the military retiree benefits afforded an individual under either the REDUX + Career Status Bonus option or the TSP Only option. This chapter develops a model that allows the user to vary selected inputs and run simulations with the model to derive given estimated cost and benefit data for potential military retirement systems and the probability of their occurrence. Data will be presented for the year 2025 and 2035 projected retirement system costs and member benefits. After presenting the 2025 and 2035 data based on the given assumptions, a ‘what if’ type analysis of the TSP Only option costs and benefits will be presented assuming that incentive contribution percentages were decreased by 5% across the board. This is done to show the power and utility of the model developed as well as present useful data for consideration in determining the most appropriate incentive contribution levels.

### **B. MODEL INFORMATION**

The model was created using the Microsoft Excel spreadsheet and Crystal Ball simulation software. The accuracy and usefulness of any model output is limited by the

quality of the input data and underlying assumptions of the model. For this reason the next sections of this chapter will define the inputs associated with the model and assumptions made inherent to the models construction. The model developed in this Chapter has several objectives. First and foremost of these objectives is to be a useful tool for the DoD when considering the costs and benefits of adapting the proposed retirement system. Secondly, the model is to be of use to the prospective military entrant in evaluating which retirement system option affords him/her the most future value. Finally, the model will be designed such that it is flexible enough to be relatively easily modified for use in considering similar retirement system proposals.

## **1. Input Data**

The model is based on actual year 2000 DoD military manpower structure, end strength and pay data. This bases the model on a real world set of DoD inputs. The model also requires a basis upon which to estimate future TSP account investment returns. For this purpose, actual return data from related securities for the period from 1981 to 2001 are used. While the data presented for analysis in the thesis is restricted to that of comparing the options as proposed, the model allows the user to vary several inputs. The potential future military member can change the desired asset allocation, pre- and post-retirement, for the purpose of determining the effect it has on future retirement option values. The DoD user can change the end strength, government matching contribution percentage, government incentive contribution percentage, the various option normal costs, the average federal income tax rate of military personnel, future average annual pay raise rate, and finally the percentage of personnel selecting each option for analysis purposes.

## **2. Model Assumptions**

Inherent to understanding the output of the model is an understanding of the assumptions that were made when creating the model. If the user fails to understand all the assumptions made he or she may reach invalid or meaningless results from use of the model. The assumptions made in creating the model are as follows:



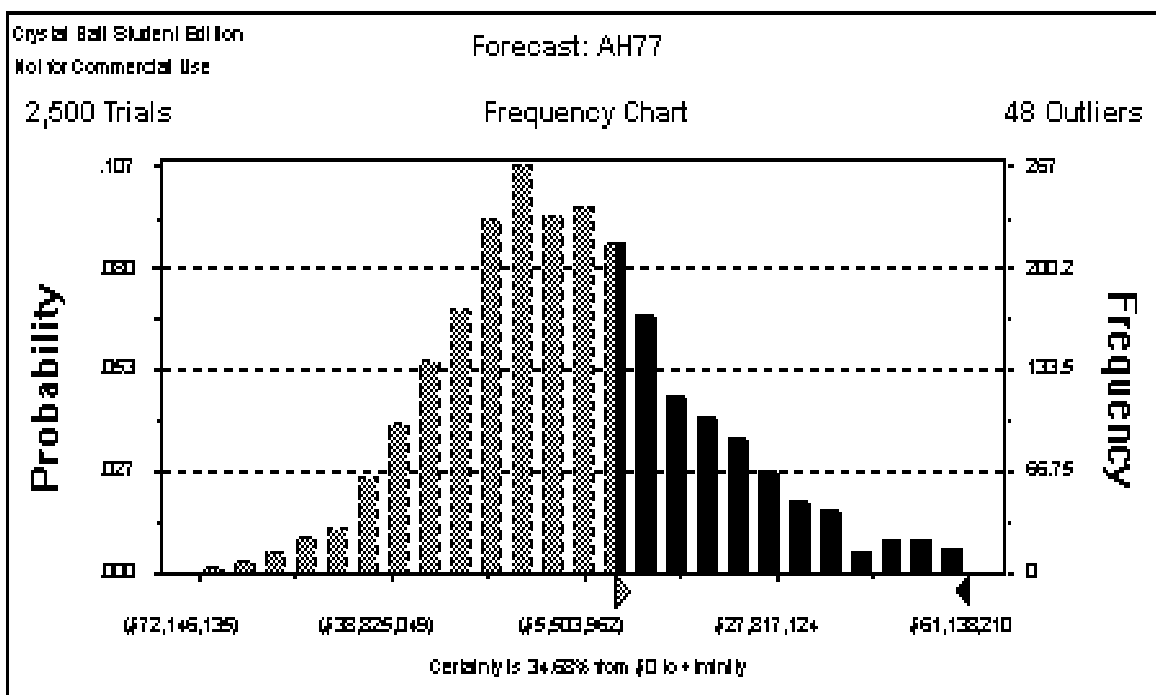
- For the purposes of determining the future costs of the HI 3 and the annuity portion of the REDUX + CSB options of the military retirement system, the normal cost data for year 2000 are used. These data are relatively stable and only change significantly when the actuaries of the Office of the Secretary of Defense change the assumptions upon which they base their calculations. The user can change these data if different values are deemed more appropriate.
- The future annual base pay raises are set at 3.5%. The user can change these data if different values are deemed more appropriate.
- The average federal income tax rate for military personnel is assumed to be 16%. The user can change these data if different values are deemed more appropriate.
- The manpower structure of the military is constant. The overall end strength numbers may be varied as compared to year 2000 data by changing the data on the input page. Evaluating changes in internal structure would require significant model revision.
- The asset allocation chosen by members for funds invested in the TSP accounts is in accordance with those presented in Table 3. The user can change these data on the input page if different values are deemed more appropriate.
- The historical return data on securities in indices closely related to the TSP funds for the period from 1981 to 2001 are representative of future returns.
- The typical enlistee enlists at age 18 and the typical officer receives his/her commission at age 22.
- The typical career progression data presented in Appendix D remain valid for future years.
- The government matching and incentive contribution rates are in accordance with those presented in Table 2. The user can change these data if different values are deemed more appropriate.

### **3. What Running the Model Simulations Does**

The Monte Carlo simulation portion of the model is utilized in order to achieve more accurate results of the future value of monies invested in the military member's TSP account. Thus the simulation portion only affects the future values of the TSP Only option and the Career Status Bonus portion of the REDUX option. The simulation uses the historical return data presented in Appendix E and the historical inflation rate data presented in Appendix G. The model then uses the relative probability of a given rate

coupled with a random number generator to reach overall rate of return results. The rates are more likely to reflect the true nature of the market than using a straight average, as would be done if using a deterministic approach. The output of this type of analysis is a range of values for the associated money stream and the overall probability of a given value being reached. This allows the user to determine what degree of certainty he/she requires of the TSP Only or REDUX + CSB options future value to forego the guaranteed annuity benefits of the HI 3 option. Figure 2 contains a sample forecast cell output from the model. The forecast cell output window shows the entire range of the potential output and the associated probability. The window is interactive when created by the Crystal Ball software such that the user can drag the arrows located below the chart to find desired dollar value or probability cut-off points. For example, Figure 2 shows that the probability of the future value of the money stream under analysis being greater than \$0 is 34.68%. The detailed reports containing this type of data for the scenarios evaluated are presented in appendices I and J.

Figure 2. Sample Model Forecast Cell Output Window



## **C. COST AND BENEFIT ANALYSIS FOR YEAR 2025 AND 2035 DOD RETIREMENT SYSTEM OPTIONS**

The estimated costs and benefits of the DoD retirement system for years 2025 and 2035 are presented in this chapter. These years are analyzed because they realistically represent the earliest possible timeframe for military members to become eligible for retirement at both the 20 and 30 years of service point under the proposed retirement system. This assumption is based on the premise that the proposed system is acted on by both the DoD and Congress and subsequently implemented in the year 2005.

### **1. Projected Costs of Each Option**

The cost of each option to the DoD is calculated in the same manner as in Chapter 5. The only difference is that the base pay data must be inflated to account for pay raises which will have occurred by the year 2025 or 2035 as is appropriate for the case under consideration. The estimated costs of the DoD retirement system options in year 2025 and 2035 are presented in table 12. The table shows the total cost for each option assuming one-third of military entrants had selected each option. The cost data are presented in this manner to show the individual option's normal cost, the weighted overall normal cost, and to allow for ease of comparison between options. When calculating these data the normal cost, manpower end strength, and incentive and matching contribution percentages were the same as were assumed in the calculations in Chapter V. The table reveals that even if only 1/3<sup>rd</sup> of future military members opt for the TSP only option it would equate to approximately a 5% reduction in the overall cost of the military retirement system. This equates to about \$4.4 and \$6.1 Billion in savings in 2025 and 2035 respectively. If one assumes a participation rate closer to 100%, as the author thinks would be the case, the savings grow to approximately \$13.0 and \$18.4 Billion for the years 2025 and 2035.

### **2. Projected Benefits of Each Option**

The benefits afforded the military retiree under each of the three options are calculated using the same methodology as in Chapter 5. The difference is that the rates of return on

the TSP funds, pre- and post-retirement, and the rates of inflation for future years are based on Monte Carlo simulation results rather than actual data or historical averages. This results in a more accurate estimation of the future value of the individual's retirement entitlements and gives the probability of the desired outcome or benefit level being reached. This allows for the individual to make a better informed decision as to which option is best for him/her and the DoD being able to make a better informed decision when establishing future incentive payment percentages and vesting period lengths. The value of the benefits of the REDUX + CSB and TSP Only options will be compared to the benefits guaranteed retiring service members under the HI 3 annuity. In the case of the REDUX + CSB analysis, the simulation results reveal the probability that the value of the bonus is sufficient to account for the lesser value of the REDUX annuity as compared to the HI 3 annuity. For the TSP Only option the simulation results give the user the probability of attaining future monies equal to the HI 3 annuity. In both cases, the results also give the member an idea of what the probability of exceeding the HI 3 annuity value is and the potential magnitude of these additional benefits.

The value that is not shown in these calculations is that of choice. The TSP Only and REDUX + CSB options both give the military member additional personal choices that are not afforded members under the HI 3 option. This is especially true of the TSP Only option. The TSP Only option has the added value of removing the 20 or nothing facet of the military retirement system, which may be of great value to many prospective future military members. The TSP Only option also has the benefit of allowing the former military member the option of when to withdraw the retirement assets. Currently a retiree is paid an annuity commencing immediately upon retirement regardless of whether he/she actually fully retires or not. The TSP Only option would allow members to go on to a second career if desired and still have all of their TSP monies remain invested for use in later years. This could dramatically lower the tax burden placed on the retirement funds when they are eventually withdrawn as well as allowing for significant accumulation of additional assets.

How one interprets the results of the model output is subject to a person's acceptance of, or aversion to, risk. As was stated earlier, the model output is a range of potential results and the given probability of achieving any given level in the range.

Table 12. Year 2025 and 2035 Projected Retirement System Option Cost Data

HI 3							Equivalent Normal Cost
	Gross Base Pay	X	Normal Cost	Percent X Opting Plan	Manpower X Assumption =	Option Cost	
2025	\$87,005,324,867		0.292	33.33%	100%	\$8,467,671,435	29.20%
2035	\$122,729,603,425		0.292	33.33%	100%	\$11,944,486,832	29.20%
<b>REDUX + Career Status Bonus</b>							
<b>--Annuity portion</b>							
2025	\$87,005,324,867		0.272	33.33%	100%	\$7,887,693,940	
2035	\$122,729,603,425		0.272	33.33%	100%	\$11,126,371,295	
<b>--Bonus portion</b>							
	Bonus Amount		Number of personnel receiving bonus				
2025	\$70,897		X	14505		\$1,028,381,369	
2035	\$100,008		X	14505		\$1,450,633,484	
2025						\$8,916,075,308	30.75%
2035						\$12,577,004,780	30.75%
<b>TSP Only</b>							
<b>5% Government Matching Contributions portion</b>							
	Gross Base Pay	X	Percent Match	Percent X Opting Plan			
2025	\$87,005,324,867		5%	33.34%		\$1,450,378,766	
2035	\$122,729,603,425		5%	33.34%		\$2,045,902,489	
<b>Deferred Tax Revenue portion</b>							
					Average X Tax Rate		
2025	\$87,005,324,867		5%	33.34%	16%	\$232,060,602	
2035	\$122,729,603,425		5%	33.34%	16%	\$327,344,398	
<b>Government Incentive Contribution portion</b>							
	Manpower Factor	X	Incentive Pay	Percent X Opting Plan			
<b>--Officer</b>							
2025	100%		\$3,198,567,396	33%		\$1,066,402,370	
2035	100%		\$4,511,895,204	33%		\$1,504,265,861	
<b>--Enlisted</b>							
2025	100%		\$4,878,278,082	33%		\$1,626,417,912	
2035	100%		\$6,881,293,016	33%		\$2,294,223,092	
2025						\$4,375,259,650	15.08%
2035						\$6,171,735,840	15.08%
<b>Equivalent entire retirement system cost and normal cost for 2025</b>						<b>\$21,759,006,394</b>	<b>25.01%</b>
<b>Equivalent entire retirement system cost and normal cost for 2035</b>						<b>\$30,693,227,451</b>	<b>25.01%</b>

Many financial advisors recommend that a probability of less than 70% should be unacceptable when planning for one's retirement goals. This study compares the REDUX + CSB and TSP Only options to the HI 3 option. The actual probability of achieving equal or greater results than those afforded the member by the HI 3 option will be presented. When there is an added probability of significant additional assets being accumulated these data are also presented.

***a. Year 2025 Benefit Projections***

The results of running the model to analyze the benefits afforded military personnel retiring in the year 2025 with twenty years of service are significantly different than those presented in Chapter V. The model reveals that neither the military officer nor military enlistee should realistically expect the retirement entitlements of the REDUX + CSB option to equal those of the HI 3 option. As Table 13 shows, the probability of the bonus and associated accumulation value being sufficient to make-up for the reduced annuity payments afforded the retiree under the REDUX option is 0.0% and 12.65% for the officer and enlisted member respectively. Obviously this is far below the commonly accepted 70% threshold cut-off value. Thus a member would be unwise to select this option. The analysis also reveals that the TSP Only option benefits have a relatively good chance of equaling or exceeding the benefits of the HI 3 option, with both the enlisted and officer probabilities being greater than 70%. The excess funds accumulated at the 70% threshold value are also worthy of note. This is another facet of what makes the TSP Only option appealing to future military members. The lump sum accumulated at retirement under the TSP Only option with a probability of 70% is also presented for consideration.

***b. Year 2035 Benefit Projections***

The results for the typical officer or enlistee retiring in the year 2035 having served for thirty years reveals that the REDUX + CSB option, while more attractive than for a member serving only twenty years, still fails to reach the 70% cut-off level that is typically applied by financial advisors. The enlisted member serving for 30 years has the best chance of his/her entitlements under the REDUX + CSB equaling or exceeding the HI 3 option benefits. The 61.45% probability may be close enough for an individual that is willing to take a risk to consider the option as a result of the significant potential upside. As can be seen by viewing the detailed result report in appendix I, by

Table 13. Model Output Results for the Typical Officer and Enlistee Retiring in Year 2025  
Having Twenty Years of Service

<b>HI 3 option retirement entitlements</b>			
	Years of Service Factor	average of 36 highest months base pay	Initial Annual Annuity
O-5	50%	\$12,462	<b>\$74,769</b>
E-8	50%	\$6,698	<b>\$40,188</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			
	Years of Service Factor	average of 36 highest months base pay	Initial Annual Annuity
<b>Annuity</b>			
O-5	40%	\$12,462	\$59,815
E-8	40%	\$6,698	\$32,150
<b>plus Bonus</b>			
	Probability of bonus making up for difference in annuity value between HI 3 and REDUX		
O-5		0.00%	
E-8		12.65%	
<b>TSP ONLY option retirement entitlements</b>			
	Probability of meeting or exceeding the benefits afforded by the HI 3 option	Excess Funds @ 70% probability	Lump Sum @ 70% Probability @ Retirement
O-5	74.15%	\$3,866,000	\$897,000
E-8	71.95%	\$460,000	\$472,566
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			

going to the 50% probability level the potential excess funds accumulated amount to approximately \$1.7 million. The HI 3 option benefits have almost no chance of exceeding the benefits of the TSP Only option for either the officer or enlistee in this scenario. The probabilities of the officer and enlisted members benefits under the TSP

Only option exceeding those of the HI 3 option are so high, 80 and 86% respectively, that the member would accumulate an extra \$18+ million at the generally accepted 70% probability level. Table 14 presents the numerical data for further review and analysis.

Table 14. Model Output Results for the Typical Officer and Enlistee Retiring in Year 2035 Having Thirty Years of Service

<b>HI 3 option retirement entitlements</b>			
	Years of Service Factor	average of 36 highest months base pay	Initial Annual Annuity
O-7	75%	\$25,729	<b>\$231,558</b>
E-9	75%	\$12,563	<b>\$113,068</b>
<b>REDUX + Career Status Bonus (CSB) option retirement entitlements</b>			
	Years of Service Factor	average of 36 highest months base pay	Initial Annual Annuity
<b>Annuity</b>			
O-7	75%	\$25,729	\$231,558
E-9	75%	\$12,563	\$113,068
plus			
<b>Bonus</b>			<b>Excess Funds @ 70% probability</b>
	Probability of bonus making up for difference in annuity value between HI 3 and REDUX		
O-7	89.76%		\$3,204,402
E-9	97.64%		\$9,182,550
<b>TSP ONLY option retirement entitlements</b>			
	Probability of meeting or exceeding the benefits afforded by the HI 3 option	Excess Funds @ 70% probability	Lump Sum @ 70% Probability @ Retirement
O-7	80.04%	\$18,440,000	\$2,825,000
E-9	86.12%	\$18,593,277	\$1,495,000
Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.			



**D. 'WHAT IF' INCENTIVE CONTRIBUTIONS WERE REDUCED BY 5% ACROSS THE BOARD ANALYSIS**

The model can easily be used to perform this analysis. For this case the user simply changes the incentive contribution data on the input page of the model. In this instance all incentive contribution percentages presented in table 2 are reduced by 5%. Thus for a member in his/her 6<sup>th</sup> to 10<sup>th</sup> year of service the percentage is decreased from 15% to 10%. Once the input page data have been updated to the desired value for consideration the Crystal Ball simulation program must be run to develop the associated output cost and benefit data. Changing the incentive contribution percentages of the TSP Only option has no direct impact on either the Hi 3 or REDUX + CSB option costs or benefits thus that data need not be repeated here. Table 15 presents the TSP Only option costs for the same four typical retiree cases evaluated under the original assumptions and the difference in option normal costs and total system costs. As can be seen the decrease in the TSP Only option normal cost is 2.51% but the overall system cost decreases by only 0.84% or about \$1 Billion per year.

Table 15. 'What if' Incentive Contributions Were Reduced by 5% Across the Board Cost Analysis of the TSP Only Option

	5% Government Matching Contributions portion					Option Costs	Normal Costs	Depicts realizable Savings in real dollars and normal cost as compared to data for original incentive contribution percentages as depicted in table 12	
	Gross Base Pay	X	Percent Match	Percent X Opting Plan					
2025	\$87,005,324,867		5%	33.34%		\$1,450,378,766			
2035	\$122,729,603,425		5%	33.34%		\$2,045,902,489			
Deferred Tax Revenue portion					Average X Tax Rate				
2025	\$87,005,324,867		5%	33.34%	16%	\$232,060,602			
2035	\$122,729,603,425		5%	33.34%	16%	\$327,344,398			
Government Incentive Contribution portion					Percent X Opting Plan				
	Manpower Factor		Incentive Pay including X Continuation Factors						
--Officer									
2025	100%		\$2,316,213,884		33.34%	\$772,225,709			
2035	100%		\$3,267,248,434		33.34%	\$1,089,300,628			
--Enlisted									
2025	100%		\$3,578,662,712		33.34%	\$1,193,126,148			
2035	100%		\$5,048,057,187		33.34%	\$1,683,022,266			
Equivalent TSP Only option Costs and normal cost for 2025						\$3,647,791,225	12.58%	\$136,068,867	2.51%
Equivalent TSP Only option Costs and normal cost for 2035						\$5,145,569,781	12.58%	\$191,938,575	2.51%
Equivalent entire retirement system cost and normal cost for 2025						\$21,031,537,969	24.17%	\$136,068,867	0.84%
Equivalent entire retirement system cost and normal cost for 2035						\$29,667,061,393	24.17%	\$191,938,575	0.84%

The benefits afforded the four typical retiree scenarios that were analyzed under the initial assumptions will now be compared to the benefits those same individuals would receive if the incentive contributions were decreased as in the ‘what if’ scenario. The benefits will obviously be reduced, the real concern to the DoD is whether or not the reduction in benefits is sufficient to change the potential military entrants selected retirement system option or his/her decision of whether or not to join the military. The primary objective of the model, as stated earlier, is to allow the DoD personnel to perform this type of analysis. Table 16 presents the effects that lowering the incentive contributions would have on the retiree benefits. The results make apparent that lowering the incentive contribution percentages by 5% across the board could change the retirement option selected by personnel considering serving for either twenty or thirty years. None of the four typical retiree cases now attain the 70% cut-off probability. At the same time the table also illustrates that a significant lump sum is still accumulated by the time the retirement point is reached in either case. Thus, if the member were planning on a second career after the military he/she would have a nice start to a retirement nest egg under the TSP Only option. This is the point at which the value of the intangibles such as the portability, flexibility, and the fact that the member could leave prior to twenty years of service and still have accrued retirement assets, comes into play. A report containing detailed results of the model output for the ‘what if’ scenario is presented in appendix J.

## **E. SUMMARY**

The utilization of the Crystal Ball simulation software coupled with the Microsoft Excel spreadsheet program resulted in a wealth of information that was not available when using a deterministic model only. Inappropriate results may have been experienced if one had based decisions about future retirement system options on the deterministically determined point estimates presented in Chapter V. For example, the REDUX + CSB option appeared to be a more valuable option than the HI 3 option in all cases when examined in Chapter V. The simulation model’s more accurate approach to estimating

Table 16. ‘What if’ Incentive Contributions Were Reduced by 5% Across the Board Benefit Analysis of the TSP Only Option

<b>TSP ONLY option retirement entitlements</b>				
	<b>Probability of meeting or exceeding the benefits afforded YOS by the HI 3 option</b>	<b>Excess Funds @ 70% probability</b>	<b>Lump Sum @ 70% Probability @ Retirement</b>	
O-7	30 51.72%	\$0	\$2,273,619	
E-9	30 61.92%	\$0	\$1,073,469	
O-5	20 37.16%	\$0	\$719,211	
E-8	20 34.68%	\$0	\$379,582	

Note: (1) All options account for 3% annual increase in annuity payments to account for COLA, (2) Real return rate for TSP and CSB calculations is based on historical TSP fund return rates and asset allocation as outlined in table 3, (3) All cases ignore income tax effects.

future returns reveals that the HI 3 option is in fact far superior to the REDUX + CSB option in the case of the typical twenty year retiree. The probability data presented for the future value of TSP Only option make it appear to be significantly more superior to the HI 3 option than it did as presented in Chapter V especially in the case of service members planning to serve their country for thirty years. The prospective military entrant could then use the probability data when making the choice of whether or not the military was right for them and which retirement option was in their best interest. The DoD could use the data to more accurately find the optimal incentive contribution percentages that would provide comparable retirement benefits to future service members and thus potentially achieve even greater cost savings than those presented in this study.

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## VII. CONCLUSIONS AND RECOMMENDATIONS

### A. INTRODUCTION

The study was undertaken to analyze the existing military retirement system and its objectives with an end goal of finding ways to improve the system's alignment with its objectives while simultaneously reducing its cost. The study presented a thorough review of the objectives of the military retirement system as well as an analysis of the alignment of the current military retirement system with its objectives. A review of recently proposed alternatives to, and modifications for, the retirement system was then presented. Based on the knowledge gained from reviewing the system's objectives and the justifications and criticisms of the proposed alternative retirement options, an alternative proposal was then presented. The proposed multi-option retirement system enhances the manpower control tools afforded the DoD over those provided by the existing system. The system accomplishes this while allowing for significant potential cost savings. As was discussed earlier, one of the main reasons that the current system has received so much attention as of late is its cost. The multi-option system also has the added benefit of being much more comparable to retirement plans available to civilian employees. These facts reveal that the proposed multi-option retirement system is better aligned with the stated objectives of the military retirement system.

### B. THE RESEARCH QUESTIONS IN REVIEW

A review of the research questions that the study set out to answer is appropriate at this point. The questions were as follows:

**The primary question that this thesis was to address was:** Given the current objectives of the DoD retirement system; can the needs of both the DoD and today's potential military entrants be better met by development of a new multi-option type retirement system than by the current defined benefit system?

**Secondary questions that have been addressed include the following:**

- What are the objectives of the retirement system and does the current system meet them?

- How would a multi-option retirement system be structured to meet the objectives of the DoD retirement?
- What, if any, cost savings can be attained by implementing the aforementioned multi-option retirement system?
- What effect would the transition to a new retirement system have on personnel accessions as well as retention?

The discussion of the proposed multi-option retirement system's degree of alignment with the stated objectives of the DoD retirement system coupled with the cost and benefit analysis results from the model make clear that a better system can be developed. The research that went into developing the proposed retirement system included an in depth discussion of the objectives of the military retirement system. The proposed system also presents one possible answer to the question of how an alternative retirement system could be structured to better meet the objectives of the retirement system. By using the model developed one can readily analyze various 'what if' scenarios/versions of proposed military retirement systems and determine the potential cost savings that might be afforded the DoD if the system were adopted. The answer to the question of what effects that transitioning to the proposed retirement system would have on future accessions and retention cannot be answered with numerical certainty. How people would react to the adoption of the proposed system can only be estimated. Based on the facts the proposed system still offers the current retirement options available to today's potential military entrant and that the TSP Only option adds to the total compensation package available to potential entrants it follows that personnel accessions should be enhanced. As to the question of future retention, proper use of the incentive contributions should have the effect of increasing the services ability to retain the proper number of personnel to meet future manning level requirements.

## **C. CONCLUSIONS**

The study makes clear that an alternative retirement system for the military can be developed that meets both the enhanced manpower control needs of the DoD and the cost-savings desired by society as a whole. While there are still areas that would require further analysis to find the ideally structured system, the study presented a viable option

that is better aligned with the system objectives than the current system. The proposed multi-option system has the benefit of enhancing the service's manpower control tools by allowing for adjustments to the incentive contribution percentages as well as the vesting period lengths. At the same time, the system has the potential to save the taxpayers up to half of the money spent on the current system.

#### **D. RECOMMENDATIONS**

A multi-option retirement system similar to that proposed by this system should be given serious consideration for adoption by both Congress and the DoD. The cost-savings afforded the military from such action might lessen the possibility of future benefit reductions in the name of cost savings. The system would also make it easier for the military to compare its retirement benefits package, and use the generosity of those benefits, to that of civilian employers for the purpose of recruiting and retaining personnel future military personnel.

#### **E. POTENTIAL AREAS FOR FUTURE STUDY**

- A study of the ideal vesting period for incentive contributions could be undertaken based on individual service make-up and manpower goals.
- A study could be undertaken to determine, with a degree of statistical significance, what percent of military personnel and potential military personnel would select each option of a system similar to the proposed multi-option retirement system.
- A study could be undertaken to attempt to determine a dollar value of the added flexibility, portability, and freedom of choice afforded individuals by an option like the TSP Only option presented in this study.
- A study of the impact of the additional unfunded liability of the Military Retirement Fund as a result of the difference between the actual versus predicted member participation rates in the REDUX with bonus option and HI 3 option.

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## APPENDIX A      YEAR 2000 MEMBER CONTINUATION DATA

Years of Service	Officer Data	Enlisted Data
1	98.72%	87.30%
2	98.27%	90.17%
3	94.75%	83.71%
4	84.98%	59.93%
5	85.33%	81.05%
6	88.26%	82.91%
7	88.60%	84.49%
8	90.05%	83.55%
9	88.71%	86.20%
10	87.39%	84.10%
11	90.50%	90.47%
12	91.54%	92.15%
13	94.49%	93.80%
14	94.51%	95.42%
15	96.06%	96.13%
16	97.44%	97.52%
17	98.06%	98.39%
18	98.40%	99.02%
19	98.87%	99.17%
20	76.03%	49.86%
21+	79.35%	68.56%
Source of data is Ref. 16		

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**APPENDIX B      YEAR 2000 OFFICER END-STRENGTH, GROSS  
BASE PAY, AND INCENTIVE PAY BY YEAR OF SERVICE**

<b>YEARS OF SERVICE</b>	<b>ANNUAL BASE PAY</b>	<b>OFFICER ENDSTRENGTH</b>	<b>INCENTIVE PAY</b>
0	\$319,831,284	11406	\$10,658,958
1	\$353,259,576	12758	\$11,925,665
2	\$409,370,652	12188	\$14,063,208
3	\$461,674,608	12210	\$16,738,806
4	\$449,043,396	10846	\$19,158,436
5	\$434,853,036	10355	\$21,742,652
6	\$433,499,328	9880	\$40,219,016
7	\$414,358,416	9334	\$43,389,581
8	\$444,276,336	9661	\$51,662,897
9	\$426,035,940	9105	\$55,846,921
10	\$422,610,828	8715	\$63,391,624
11	\$478,360,140	9535	\$93,910,055
12	\$478,427,160	9204	\$102,603,465
13	\$472,560,060	9016	\$107,254,956
14	\$497,208,840	9258	\$119,404,703
15	\$499,169,448	9160	\$124,792,362
16	\$528,783,000	9369	\$76,708,589
17	\$531,152,064	9076	\$78,576,647
18	\$520,247,712	8503	\$78,214,937
19	\$514,981,632	8264	\$78,308,107
20	\$384,598,800	5949	\$57,689,820
21	\$336,191,580	5044	\$19,992,441
22	\$282,929,076	4086	\$21,203,602
23	\$257,405,112	3625	\$24,310,970
24	\$219,191,448	3009	\$26,089,262
25	\$183,883,512	2460	\$27,582,527
26	\$160,075,596	2066	\$6,346,187
27	\$134,945,700	1703	\$6,742,172
28	\$110,808,456	1380	\$6,976,969
29	\$92,663,460	1130	\$7,352,846
30+	\$131,508,564	1515	\$13,150,856
Totals	\$11,383,904,760	229810	\$1,353,464,163
Source data adapted from Ref's 14 and 16			

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**APPENDIX C    YEAR 2000 ENLISTED END-STRENGTH, GROSS  
BASE PAY, AND INCENTIVE PAY BY YEAR OF SERVICE**

<b>YEARS OF SERVICE</b>	<b>ANNUAL BASE PAY</b>	<b>ENLISTED ENDSTRENGTH</b>	<b>INCENTIVE PAY</b>
0	\$2,383,019,136	174153	\$38,137,172
1	\$2,129,160,684	144768	\$39,031,492
2	\$2,131,784,700	128667	\$43,339,908
3	\$2,070,841,128	113678	\$50,293,757
4	\$1,350,013,116	68682	\$54,709,282
5	\$995,335,944	49661	\$49,766,797
6	\$920,548,080	43323	\$70,663,112
7	\$906,766,740	41738	\$82,382,802
8	\$859,012,680	37670	\$93,410,156
9	\$742,020,420	31819	\$93,605,876
10	\$749,562,528	30624	\$112,434,379
11	\$773,731,344	31151	\$153,365,167
12	\$744,753,432	28555	\$160,196,755
13	\$837,727,128	31722	\$192,106,006
14	\$939,593,532	34262	\$225,807,816
15	\$974,305,716	34511	\$243,576,429
16	\$1,035,040,584	35281	\$99,722,658
17	\$1,014,228,912	33432	\$99,316,520
18	\$1,020,902,928	32917	\$100,959,463
19	\$1,056,136,992	33480	\$105,317,981
20	\$530,319,768	15553	\$106,063,954
21	\$365,423,544	10204	\$12,110,749
22	\$275,402,664	7162	\$13,312,874
23	\$205,636,608	5170	\$14,498,842
24	\$130,299,816	3035	\$13,400,033
25	\$96,219,072	2176	\$14,432,861
26	\$63,280,716	1330	\$1,398,153
27	\$52,442,736	1088	\$1,690,043
28	\$40,387,380	830	\$1,898,398
29	\$32,855,820	675	\$2,252,595
30+	\$5,382,660	113	\$538,266
Totals	\$25,432,136,508	1207430	\$2,064,228,683

Source data adapted from Ref's 14 and 16

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## APPENDIX D      TYPICAL DOD CAREER PROGRESSION

Year of Service	Pay Rate	Pay Rate
0	O-1	E-1
1	O-1	E-2
2	O-2	E-3
3	O-2	E-4
4	O-3	E-5
5	O-3	E-5
6	O-3	E-5
7	O-3	E-5
8	O-3	E-6
9	O-3	E-6
10	O-4	E-6
11	O-4	E-6
12	O-4	E-7
13	O-4	E-7
14	O-4	E-7
15	O-4	E-7
16	O-5	E-7
17	O-5	E-8
18	O-5	E-8
19	O-5	E-8
20	O-5	E-8
21	O-5	E-9
22	O-6	E-9
23	O-6	E-9
24	O-6	E-9
25	O-6	E-9
26	O-6	E-9
27	O-7	E-9
28	O-7	E-9
29	O-7	E-9
30	O-7	E-9
Souce data adapted from Ref. 5		

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## APPENDIX E      HISTORICAL TSP RETURN DATA

<b>TSP fund Related index</b>	<b>G-fund Related Sec.</b>	<b>F-fund LBA</b>	<b>C- fund S&amp;P 500</b>	<b>S- fund Wilshire 4500</b>	<b>I- fund EAFE</b>	<b>Inflation Rate Data</b>
1981	14.18	6.26	-5.09	-1.65	-2.28	10.36
1982	13.56	32.64	21.08	13.73	-1.86	6.16
1983	11.61	8.37	22.39	24.75	23.69	3.21
1984	13.12	15.15	6.11	-1.72	7.38	4.37
1985	11.33	22.13	32.04	32.02	56.16	3.54
1986	8.29	15.25	18.55	11.76	67.42	1.86
1987	8.73	2.76	5.23	-3.51	27.40	3.66
1988	9.19	7.89	16.61	20.54	28.25	4.12
1989	9.01	14.53	31.69	23.94	10.36	4.81
1990	8.97	8.96	-3.10	-13.56	-23.59	5.39
1991	8.26	16.00	30.47	43.45	12.19	4.22
1992	7.32	7.40	7.62	11.87	-12.22	3.01
1993	6.23	9.75	10.08	14.57	32.68	2.98
1994	7.29	-2.92	1.32	-2.66	7.75	2.6
1995	7.10	18.47	37.58	33.48	11.27	2.76
1996	6.80	3.63	22.96	17.18	6.14	2.96
1997	6.80	9.65	33.36	25.69	1.55	2.35
1998	5.77	8.69	28.58	8.63	20.09	1.51
1999	6.03	-0.82	21.04	35.49	26.72	2.21
2000	6.42	11.63	-9.10	-15.77	-14.17	3.38
2001	5.39	8.61	-11.94	-9.04	-21.94	2.86
<b>Average rate of return</b>	8.64%	10.67%	15.12%	12.82%	12.52%	3.73%
Source data adapted from Ref. 15						

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## APPENDIX F      YEAR 2000 AVERAGE BASE PAY TABLE

Rate	Years of Service														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
O-10	8215	8504	8504	8504	8504	8504	8504	8830	8830	8830	8830	9320	9320	9320	9320
O-9	7281	7472	7631	7631	7631	7631	7631	7825	7825	7825	7825	8150	8150	8150	8150
O-8	6594	6801	6953	6973	6973	7062	7062	7472	7472	7506	7506	7825	7825	7865	7865
O-7	5480	5852	5852	5873	5873	6115	6115	6198	6198	6472	6472	6569	6569	6828	6828
O-6	4061	4462	4754	4754	4754	4763	4763	4866	4866	4879	4879	4879	4879	5043	5043
O-5	3248	3814	4078	4103	4103	4185	4185	4185	4185	4311	4311	4543	4543	4848	4848
O-4	2738	3334	3556	3581	3581	3717	3717	3881	3881	4146	4146	4366	4366	4536	4536
O-3	2544	2844	3077	3365	3365	3526	3526	3677	3677	3850	3850	4040	4040	4139	4139
O-2	2219	2475	2911	3009	3009	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071
O-1	1926	2005	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423
O-3E	0	0	0	3365	3365	3526	3526	3677	3677	3850	3850	4040	4040	4200	4200
O-2E	0	0	0	3009	3009	3071	3071	3169	3169	3334	3334	3461	3461	3556	3556
O-1E	0	0	0	2423	2423	2588	2588	2684	2684	2781	2781	2878	2878	3009	3009
W-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W-4	2592	2785	2825	2896	2896	3029	3029	3161	3161	3294	3294	3473	3473	3622	3622
W-3	2356	2555	2555	2588	2588	2657	2657	2813	2813	2974	2974	3071	3071	3173	3173
W-2	2063	2233	2233	2302	2302	2423	2423	2555	2555	2653	2653	2750	2750	2844	2844
W-1	1719	1971	1971	2136	2136	2233	2233	2330	2330	2428	2428	2528	2528	2626	2626
E-9	0	0	0	0	0	0	0	0	0	3015	3015	3083	3083	3161	3161
E-8	0	0	0	0	0	0	0	2528	2528	2602	2602	2670	2670	2745	2745
E-7	1766	1917	1989	2059	2059	2132	2132	2202	2202	2273	2273	2345	2345	2434	2434
E-6	1519	1667	1740	1811	1811	1882	1882	1953	1953	2025	2025	2113	2113	2182	2182
E-5	1333	1472	1544	1614	1614	1703	1703	1775	1775	1846	1846	1917	1917	1934	1934
E-4	1243	1343	1419	1509	1509	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
E-3	1172	1248	1309	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336
E-2	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127
E-1	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006

Rate	Years of Service														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
O-10	9986	9986	9986	9986	10681	10681	10681	10681	10681	10681	11318	11318	11318	11318	11318
O-9	8830	8830	8830	8830	9320	9320	9320	9320	9320	9320	9986	9986	9986	9986	9986
O-8	8150	8150	8504	8504	8830	8830	9048	9048	9048	9048	9048	9048	9048	9048	9048
O-7	7472	7472	7985	7985	7985	7985	7985	7985	7985	7985	7985	7985	7985	7985	7985
O-6	5742	5742	6035	6035	6248	6248	6509	6509	6703	6703	7032	7032	7032	7032	7032
O-5	5182	5182	5402	5402	5557	5557	5738	5738	5738	5738	5738	5738	5738	5738	5738
O-4	4709	4709	4797	4797	4797	4797	4797	4797	4797	4797	4797	4797	4797	4797	4797
O-3	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139	4139
O-2	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071	3071
O-1	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423	2423
O-3E	4246	4246	4309	4309	4309	4309	4309	4309	4309	4309	4309	4309	4309	4309	4309
O-2E	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556	3556
O-1E	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009	3009
W-5	0	0	0	0	4449	4449	4610	4610	4754	4754	4930	4930	4930	4930	4930
W-4	3752	3752	3869	3869	3997	3997	4131	4131	4262	4262	4427	4427	4427	4427	4427
W-3	3281	3281	3392	3392	3518	3518	3641	3641	3701	3701	3825	3825	3825	3825	3825
W-2	2947	2947	3049	3049	3150	3150	3267	3267	3321	3321	3321	3321	3321	3321	3321
W-1	2726	2726	2823	2823	2911	2911	2911	2911	2911	2911	2911	2911	2911	2911	2911
E-9	3249	3249	3336	3336	3417	3417	3574	3574	3710	3710	3899	3899	3899	3899	3899
E-8	2826	2826	2904	2904	2986	2986	3140	3140	3277	3277	3475	3475	3475	3475	3475
E-7	2505	2505	2577	2577	2630	2630	2781	2781	2919	2919	3127	3127	3127	3127	3127
E-6	2244	2244	2280	2280	2280	2280	2281	2281	2281	2281	2281	2281	2281	2281	2281
E-5	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934	1934
E-4	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
E-3	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336	1336
E-2	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127	1127
E-1	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006

Note: Values rounded to nearest dollar, values are average of Jan and Jul payable entries.  
Source data adapted from Ref. 7

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## APPENDIX G      HISTORICAL INFATION RATE DATA

Year	Inflation Rate
1981	10.36
1982	6.16
1983	3.21
1984	4.37
1985	3.54
1986	1.86
1987	3.66
1988	4.12
1989	4.81
1990	5.39
1991	4.22
1992	3.01
1993	2.98
1994	2.6
1995	2.76
1996	2.96
1997	2.35
1998	1.51
1999	2.21
2000	3.38
2001	2.86
<b>Average</b>	3.73%
Source data adapted from Ref. 17	

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**APPENDIX H1 DETERMINISTICALLY FOUND TSP ONLY  
BENEFITS FOR AN O-7 RETIRING IN YEAR 2000 WITH 30 YEARS  
OF SERVICE**

<b>Calendar Year</b>	<b>Year of Service</b>	<b>Pay Rate</b>	<b>Monthly Base Pay</b>	<b>Member 5%</b>	<b>Govt 5%</b>	<b>Govt Incentive</b>	<b>Total Accumulated</b>
1970	0	O-1	\$418	\$21	\$21	\$21	\$752
1971	1	1	\$473	\$24	\$24	\$24	\$1,675
1972	2	2	\$690	\$35	\$35	\$35	\$3,077
1973	3	2	\$909	\$45	\$45	\$45	\$5,006
1974	4	3	\$1,108	\$55	\$55	\$55	\$7,478
1975	5	3	\$1,163	\$58	\$58	\$58	\$10,283
1976	6	3	\$1,263	\$63	\$63	\$189	\$15,052
1977	7	3	\$1,341	\$67	\$67	\$201	\$20,509
1978	8	3	\$1,467	\$73	\$73	\$220	\$26,863
1979	9	3	\$1,570	\$79	\$79	\$236	\$34,132
1980	10	4	\$1,753	\$88	\$88	\$263	\$42,643
1981	11	4	\$2,216	\$111	\$111	\$554	\$46,863
1982	12	4	\$2,305	\$115	\$115	\$576	\$60,890
1983	13	4	\$2,305	\$115	\$115	\$576	\$81,586
1984	14	4	\$2,532	\$127	\$127	\$633	\$93,273
1985	15	4	\$2,633	\$132	\$132	\$658	\$133,519
1986	16	5	\$2,838	\$142	\$142	\$568	\$175,679
1987	17	5	\$3,093	\$155	\$155	\$619	\$193,396
1988	18	5	\$3,585	\$179	\$179	\$717	\$234,456
1989	19	5	\$3,732	\$187	\$187	\$746	\$289,686
1990	20	5	\$3,983	\$199	\$199	\$797	\$265,226
1991	21	5	\$4,147	\$207	\$207	\$622	\$339,415
1992	22	6	\$5,054	\$253	\$253	\$758	\$360,237
1993	23	6	\$5,240	\$262	\$262	\$786	\$421,048
1994	24	6	\$5,537	\$277	\$277	\$831	\$432,966
1995	25	6	\$5,681	\$284	\$284	\$852	\$558,675
1996	26	6	\$6,103	\$305	\$305	\$610	\$642,878
1997	27	7	\$7,154	\$358	\$358	\$715	\$782,396
1998	28	7	\$7,355	\$368	\$368	\$736	\$935,051
1999	29	7	\$7,620	\$381	\$381	\$762	\$1,146,352
2000	30	7	\$7,985	\$399	\$399	\$799	<b>\$1,024,372</b>
<b>Total contributions by source</b>				<b>\$61,952</b>	<b>\$61,952</b>	<b>\$183,140</b>	

Note: Rates of return and inflation for 1970-1980 time frame based on average of past 20 years due to lack of similar investment vehicle for comparison in the case of some of the TSP funds. All other data is actual.

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**APPENDIX H2 DETERMINISTICALLY FOUND TSP ONLY  
BENEFITS FOR AN E-9 RETIRING IN YEAR 2000 WITH 30 YEARS  
OF SERVICE**

<b>Calendar Year</b>	<b>Year of Service</b>	<b>Pay Rate</b>	<b>Monthly Base Pay</b>	<b>Member 5%</b>	<b>Govt 5%</b>	<b>Govt Incentive</b>	<b>Total Accumulated</b>
1970	0	E-1	\$133	\$7	\$7	\$7	\$239
1971	1	2	\$224	\$11	\$11	\$11	\$665
1972	2	3	\$363	\$18	\$18	\$18	\$1,382
1973	3	4	\$439	\$22	\$22	\$22	\$2,304
1974	4	5	\$513	\$26	\$26	\$26	\$3,447
1975	5	5	\$539	\$27	\$27	\$27	\$4,745
1976	6	5	\$595	\$30	\$30	\$89	\$6,983
1977	7	5	\$632	\$32	\$32	\$95	\$9,544
1978	8	6	\$761	\$38	\$38	\$114	\$12,736
1979	9	6	\$815	\$41	\$41	\$122	\$16,394
1980	10	6	\$946	\$47	\$47	\$142	\$20,794
1981	11	6	\$1,099	\$55	\$55	\$275	\$22,929
1982	12	7	\$1,143	\$57	\$57	\$286	\$29,856
1983	13	7	\$1,143	\$57	\$57	\$286	\$40,057
1984	14	7	\$1,378	\$69	\$69	\$345	\$46,362
1985	15	7	\$1,498	\$75	\$75	\$375	\$67,161
1986	16	7	\$1,582	\$79	\$79	\$316	\$88,924
1987	17	8	\$1,635	\$82	\$82	\$327	\$98,142
1988	18	8	\$1,999	\$100	\$100	\$400	\$119,625
1989	19	8	\$1,999	\$100	\$100	\$400	\$148,147
1990	20	8	\$2,122	\$106	\$106	\$424	\$135,944
1991	21	9	\$2,183	\$109	\$109	\$327	\$174,143
1992	22	9	\$2,764	\$138	\$138	\$415	\$185,338
1993	23	9	\$2,866	\$143	\$143	\$430	\$217,135
1994	24	9	\$3,043	\$152	\$152	\$456	\$223,844
1995	25	9	\$3,122	\$156	\$156	\$468	\$289,391
1996	26	9	\$3,377	\$169	\$169	\$338	\$333,525
1997	27	9	\$3,479	\$174	\$174	\$348	\$405,349
1998	28	9	\$3,576	\$179	\$179	\$358	\$483,874
1999	29	9	\$3,705	\$185	\$185	\$371	\$592,648
2000	30	9	\$3,899	\$195	\$195	\$390	<b>\$529,035</b>
<b>Total contributions by source</b>				<b>\$32,143</b>	<b>\$32,143</b>	<b>\$96,070</b>	

Note: Rates of return and inflation for 1970-1980 time frame based on average of past 20 years due to lack of similar investment vehicle for comparison in the case of some of the TSP funds. All other data is actual.

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**APPENDIX H3 DETERMINISTICALLY FOUND TSP ONLY  
BENEFITS FOR AN O-5 RETIRING IN YEAR 2000 WITH 20 YEARS  
OF SERVICE**

<b>Calendar Year</b>	<b>Year of Service</b>	<b>Pay Rate</b>	<b>Monthly Base Pay</b>	<b>Member 5%</b>	<b>Govt 5%</b>	<b>Govt Incentive</b>	<b>Total Accumulated</b>
1980	0	O-1	\$925	\$46	\$46	\$46	\$1,665
1981	1	1	\$1,057	\$53	\$53	\$53	\$3,369
1982	2	2	\$1,382	\$69	\$69	\$69	\$6,169
1983	3	2	\$1,382	\$69	\$69	\$69	\$9,773
1984	4	3	\$1,438	\$72	\$72	\$72	\$12,487
1985	5	3	\$2,076	\$104	\$104	\$104	\$20,131
1986	6	3	\$2,139	\$107	\$107	\$321	\$31,365
1987	7	3	\$2,308	\$115	\$115	\$346	\$39,464
1988	8	3	\$2,439	\$122	\$122	\$366	\$52,526
1989	9	3	\$2,539	\$127	\$127	\$381	\$69,506
1990	10	4	\$2,910	\$146	\$146	\$437	\$68,927
1991	11	4	\$3,029	\$151	\$151	\$757	\$97,696
1992	12	4	\$3,334	\$167	\$167	\$834	\$113,328
1993	13	4	\$3,587	\$179	\$179	\$897	\$142,578
1994	14	4	\$3,694	\$185	\$185	\$924	\$156,504
1995	15	4	\$3,790	\$190	\$190	\$948	\$211,702
1996	16	5	\$4,417	\$221	\$221	\$883	\$253,960
1997	17	5	\$4,810	\$241	\$241	\$962	\$319,608
1998	18	5	\$4,944	\$247	\$247	\$989	\$392,555
1999	19	5	\$5,122	\$256	\$256	\$1,024	\$492,025
2000	20	5	\$5,557	\$278	\$278	\$1,111	<b>\$451,450</b>
<b>Total contributions by source</b>				\$37,728	\$37,728	\$139,101	
<p>Note: Rates of return and inflation for 1970-1980 time frame based on average of past 20 years due to lack of similar investment vehicle for comparison in the case of some of the TSP funds. All other data is actual.</p>							

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**APPENDIX H4 DETERMINISTICALLY FOUND TSP ONLY  
BENEFITS FOR AN E-8 RETIRING IN YEAR 2000 WITH 20 YEARS  
OF SERVICE**

<b>Calendar Year</b>	<b>Year of Service</b>	<b>Pay Rate</b>	<b>Monthly Base Pay</b>	<b>Member 5%</b>	<b>Govt 5%</b>	<b>Govt Incentive</b>	<b>Total Accumulated</b>
1980	0	E-1	\$501	\$25	\$25	\$25	\$902
1981	1	2	\$618	\$31	\$31	\$31	\$1,907
1982	2	3	\$705	\$35	\$35	\$35	\$3,352
1983	3	4	\$705	\$35	\$35	\$35	\$5,228
1984	4	5	\$825	\$41	\$41	\$41	\$6,780
1985	5	5	\$980	\$49	\$49	\$49	\$10,666
1986	6	5	\$1,009	\$50	\$50	\$151	\$16,245
1987	7	5	\$1,108	\$55	\$55	\$166	\$20,178
1988	8	6	\$1,291	\$65	\$65	\$194	\$26,988
1989	9	6	\$1,343	\$67	\$67	\$201	\$35,828
1990	10	6	\$1,443	\$72	\$72	\$216	\$35,358
1991	11	6	\$1,502	\$75	\$75	\$376	\$49,899
1992	12	7	\$1,815	\$91	\$91	\$454	\$58,354
1993	13	7	\$1,882	\$94	\$94	\$471	\$73,562
1994	14	7	\$2,010	\$101	\$101	\$503	\$81,184
1995	15	7	\$2,063	\$103	\$103	\$516	\$110,225
1996	16	7	\$2,172	\$109	\$109	\$434	\$131,767
1997	17	8	\$2,239	\$112	\$112	\$448	\$164,904
1998	18	8	\$2,648	\$132	\$132	\$530	\$202,891
1999	19	8	\$2,744	\$137	\$137	\$549	\$254,651
2000	20	8	\$2,986	\$149	\$149	\$597	<b>\$234,046</b>
<b>Total contributions by source</b>				\$19,554	\$19,554	\$72,259	
<p>Note: Rates of return and inflation for 1970-1980 time frame based on average of past 20 years due to lack of similar investment vehicle for comparison in the case of some of the TSP funds. All other data is actual.</p>							

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# APPENDIX I DETAILED REPORT OF MODEL OUTPUT FOR THE ORIGINAL SET OF ASSUMPTIONS

## Crystal Ball Report

Simulation started on 5/15/02 at 22:29:37

Simulation stopped on 5/15/02 at 22:30:15

**Forecast:** 30 year O-7 accumulation

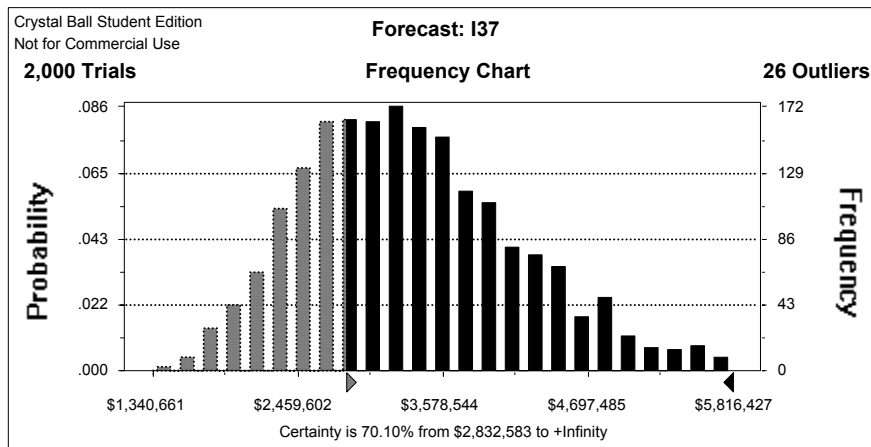
**Cell:** I37

### Summary:

Certainty Level is 70.10%  
 Certainty Range is from \$2,832,583 to +Infinity  
 Display Range is from \$1,340,661 to \$5,816,427  
 Entire Range is from \$1,225,539 to \$8,228,228  
 After 2,000 Trials, the Std. Error of the Mean is \$20,076

### Statistics:

	<u>Value</u>
Trials	2000
Mean	\$3,363,915
Median	\$3,256,472
Mode	---
Standard Deviation	\$897,834
Variance	8E+11
Skewness	0.82
Kurtosis	4.33
Coeff. of Variability	0.27
Range Minimum	\$1,225,539
Range Maximum	\$8,228,228
Range Width	\$7,002,689
Mean Std. Error	\$20,076.18



**Forecast: I37 (cont'd)**

**Cell: I37**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$1,225,539
10%	\$2,315,898
20%	\$2,603,129
30%	\$2,833,342
40%	\$3,045,453
50%	\$3,256,472
60%	\$3,477,334
70%	\$3,729,927
80%	\$4,055,723
90%	\$4,532,935
100%	\$8,228,228

End of Forecast

**Forecast:** 30 year E-9 Accumulation

**Cell: Q37**

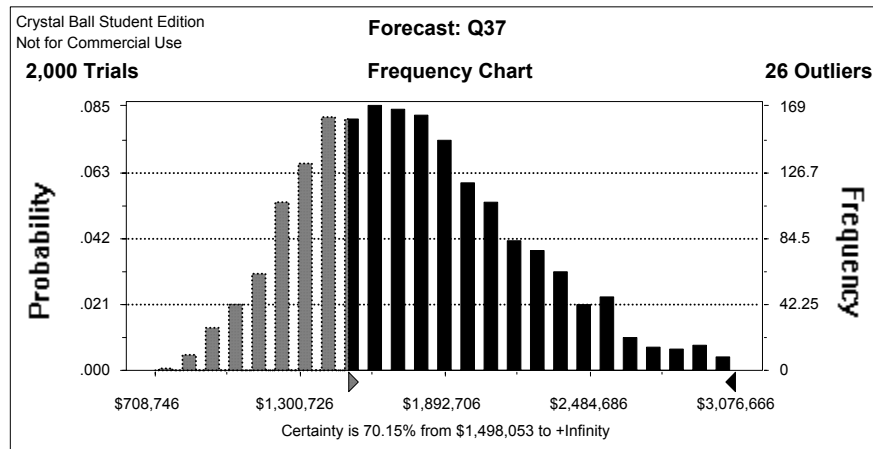
Summary:

Certainty Level is 70.15%  
Certainty Range is from \$1,498,053 to +Infinity  
Display Range is from \$708,746 to \$3,076,666  
Entire Range is from \$643,613 to \$4,340,621  
After 2,000 Trials, the Std. Error of the Mean is \$10,602

Statistics:

	<u>Value</u>
Trials	2000
Mean	\$1,780,761
Median	\$1,726,581
Mode	---
Standard Deviation	\$474,124
Variance	2E+11
Skewness	0.81
Kurtosis	4.29
Coeff. of Variability	0.27
Range Minimum	\$643,613
Range Maximum	\$4,340,621
Range Width	\$3,697,009
Mean Std. Error	\$10,601.72





**Forecast: Q37 (cont'd)**

**Cell: Q37**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$643,613
10%	\$1,225,800
20%	\$1,378,058
30%	\$1,501,106
40%	\$1,612,440
50%	\$1,726,581
60%	\$1,838,911
70%	\$1,975,460
80%	\$2,148,246
90%	\$2,399,358
100%	\$4,340,621

End of Forecast

**Forecast:** 20 year retiree bonus accumulation

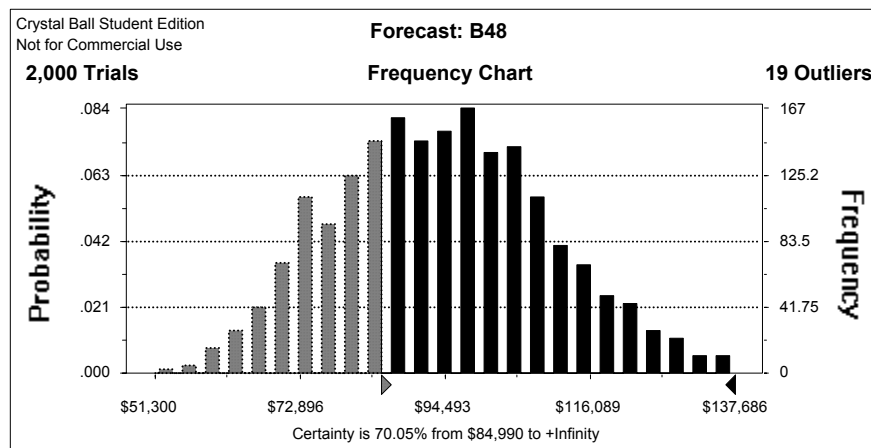
**Cell: B48**

**Summary:**

Certainty Level is 70.05%  
Certainty Range is from \$84,990 to +Infinity  
Display Range is from \$51,300 to \$137,686  
Entire Range is from \$49,576 to \$164,068  
After 2,000 Trials, the Std. Error of the Mean is \$373

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	\$94,457
Median	\$93,530
Mode	---
Standard Deviation	\$16,703
Variance	\$278,997,535
Skewness	0.35
Kurtosis	3.13
Coeff. of Variability	0.18
Range Minimum	\$49,576
Range Maximum	\$164,068
Range Width	\$114,493
Mean Std. Error	\$373.50



**Forecast: B48 (cont'd)**

**Cell: B48**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$49,576
10%	\$73,447
20%	\$79,832
30%	\$85,015
40%	\$89,228
50%	\$93,530
60%	\$98,260
70%	\$102,846
80%	\$108,173
90%	\$116,106
100%	\$164,068

End of Forecast

**Forecast:** 30 year probability for TSP Only Option

**Cell: Z77**

Summary:

Certainty Level is 74.15%  
Certainty Range is from \$0 to +Infinity  
Display Range is from (\$88,455,374) to \$232,238,471  
Entire Range is from (\$101,724,644) to \$426,803,854  
After 2,000 Trials, the Std. Error of the Mean is \$1,514,597

Statistics:

	<u>Value</u>
Trials	2000
Mean	\$45,784,563
Median	\$34,873,635
Mode	---
Standard Deviation	\$67,734,839
Variance	5E+15
Skewness	1.22
Kurtosis	5.43
Coeff. of Variability	1.48
Range Minimum	(\$101,724,644)
Range Maximum	\$426,803,854
Range Width	\$528,528,498
Mean Std. Error	\$1,514,597.05



**Forecast:** 20 year O-5 Accumulation

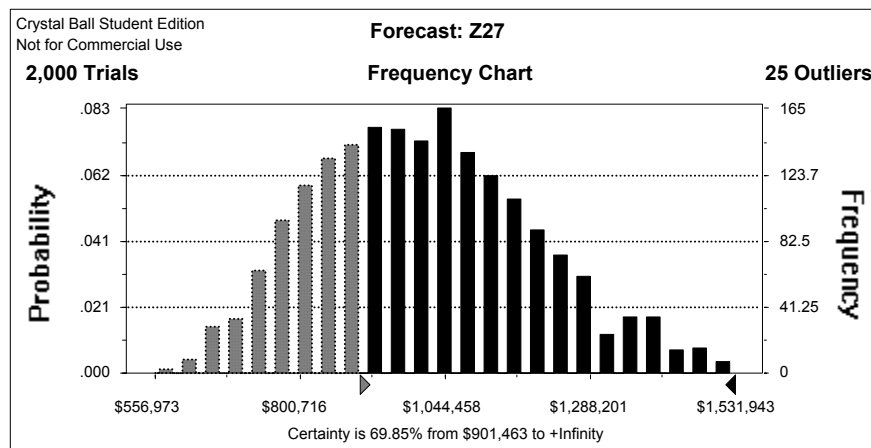
**Cell: Z27**

**Summary:**

Certainty Level is 69.85%  
Certainty Range is from \$901,463 to +Infinity  
Display Range is from \$556,973 to \$1,531,943  
Entire Range is from \$556,973 to \$1,962,849  
After 2,000 Trials, the Std. Error of the Mean is \$4,423

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	\$1,017,653
Median	\$1,002,568
Mode	---
Standard Deviation	\$197,819
Variance	\$39,132,497,258
Skewness	0.62
Kurtosis	3.75
Coeff. of Variability	0.19
Range Minimum	\$556,973
Range Maximum	\$1,962,849
Range Width	\$1,405,875
Mean Std. Error	\$4,423.38



**Forecast: Z27 (cont'd)**

**Cell: Z27**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$556,973
10%	\$780,823
20%	\$845,184
30%	\$900,406
40%	\$950,262
50%	\$1,002,568
60%	\$1,051,989
70%	\$1,107,232
80%	\$1,172,708
90%	\$1,270,417
100%	\$1,962,849

End of Forecast

**Forecast:** 20 year E-8 Accumulation

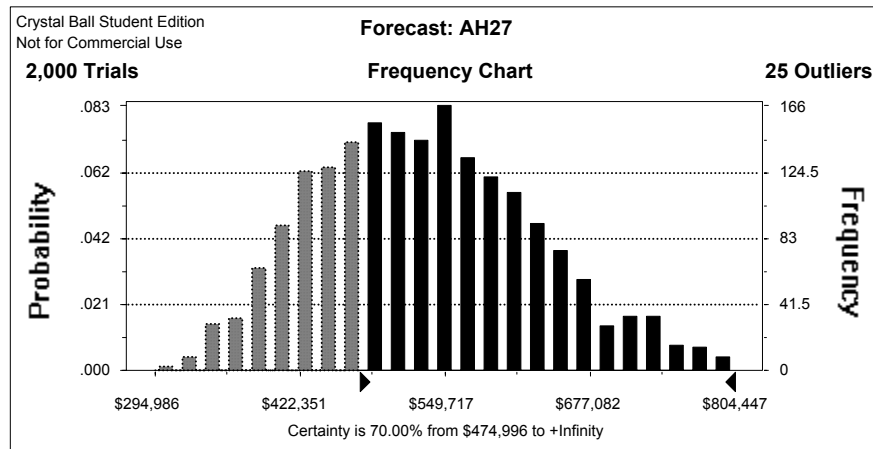
**Cell: AH27**

Summary:

Certainty Level is 70.00%  
Certainty Range is from \$474,996 to +Infinity  
Display Range is from \$294,986 to \$804,447  
Entire Range is from \$294,986 to \$1,024,154  
After 2,000 Trials, the Std. Error of the Mean is \$2,309

Statistics:

	<u>Value</u>
Trials	2000
Mean	\$536,082
Median	\$528,293
Mode	---
Standard Deviation	\$103,260
Variance	\$10,662,710,131
Skewness	0.61
Kurtosis	3.72
Coeff. of Variability	0.19
Range Minimum	\$294,986
Range Maximum	\$1,024,154
Range Width	\$729,168
Mean Std. Error	\$2,308.97



**Forecast: AH27 (cont'd)**

**Cell: AH27**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$294,986
10%	\$411,765
20%	\$446,422
30%	\$474,979
40%	\$501,301
50%	\$528,293
60%	\$553,713
70%	\$583,014
80%	\$617,590
90%	\$667,752
100%	\$1,024,154

End of Forecast

**Forecast:** 20 year E-8 probability for TSP Only Option

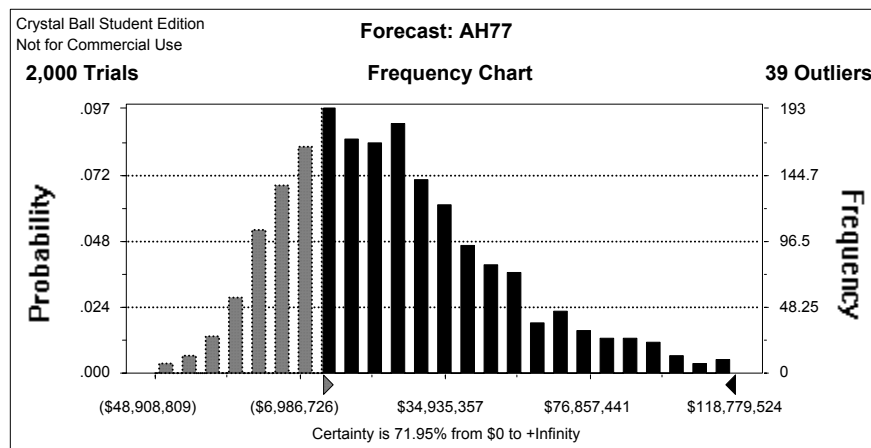
**Cell:** AH77

**Summary:**

Certainty Level is 71.95%  
Certainty Range is from \$0 to +Infinity  
Display Range is from (\$48,908,809) to \$118,779,524  
Entire Range is from (\$57,715,680) to \$217,604,439  
After 2,000 Trials, the Std. Error of the Mean is \$787,123

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	\$21,785,199
Median	\$16,249,271
Mode	---
Standard Deviation	\$35,201,208
Variance	1E+15
Skewness	1.19
Kurtosis	5.36
Coeff. of Variability	1.62
Range Minimum	(\$57,715,680)
Range Maximum	\$217,604,439
Range Width	\$275,320,119
Mean Std. Error	\$787,122.95





**Forecast: AH77 (cont'd)****Cell: AH77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$57,715,680)
10%	(\$15,881,185)
20%	(\$6,331,704)
30%	\$776,668
40%	\$8,171,238
50%	\$16,249,271
60%	\$23,578,472
70%	\$32,598,480
80%	\$45,803,284
90%	\$67,754,044
100%	\$217,604,439

End of Forecast

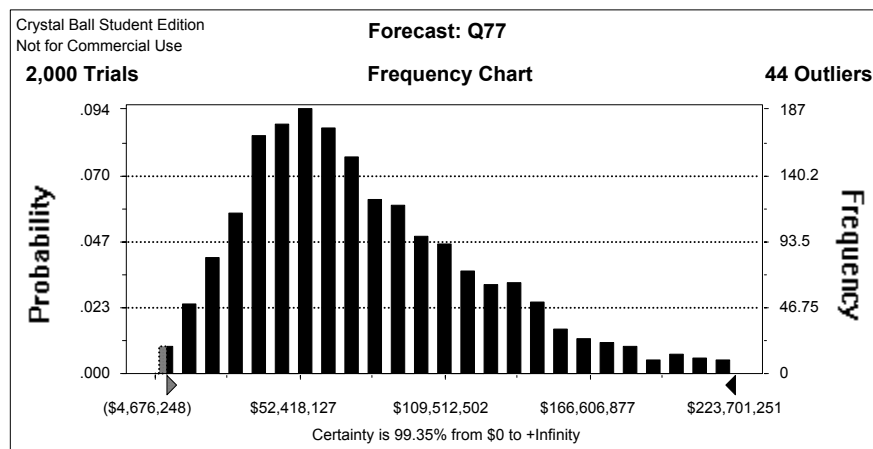
**Forecast:** 30 year O-7 probability for TSP Only Option**Cell: Q77**

Summary:

Certainty Level is 99.35%  
 Certainty Range is from \$0 to +Infinity  
 Display Range is from (\$4,676,248) to \$223,701,251  
 Entire Range is from (\$12,743,305) to \$519,290,354  
 After 2,000 Trials, the Std. Error of the Mean is \$1,180,159

Statistics:

	<u>Value</u>
Trials	2000
Mean	\$80,754,067
Median	\$69,471,635
Mode	---
Standard Deviation	\$52,778,324
Variance	3E+15
Skewness	1.55
Kurtosis	8.11
Coeff. of Variability	0.65
Range Minimum	(\$12,743,305)
Range Maximum	\$519,290,354
Range Width	\$532,033,659
Mean Std. Error	\$1,180,159.21



**Forecast: Q77 (cont'd)**

**Cell: Q77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$12,743,305)
10%	\$25,326,916
20%	\$38,460,633
30%	\$49,230,231
40%	\$58,719,083
50%	\$69,471,635
60%	\$82,525,201
70%	\$97,818,846
80%	\$117,522,245
90%	\$146,880,017
100%	\$519,290,354

End of Forecast

**Forecast:** 30 year O-7 probability for TSP Only Option

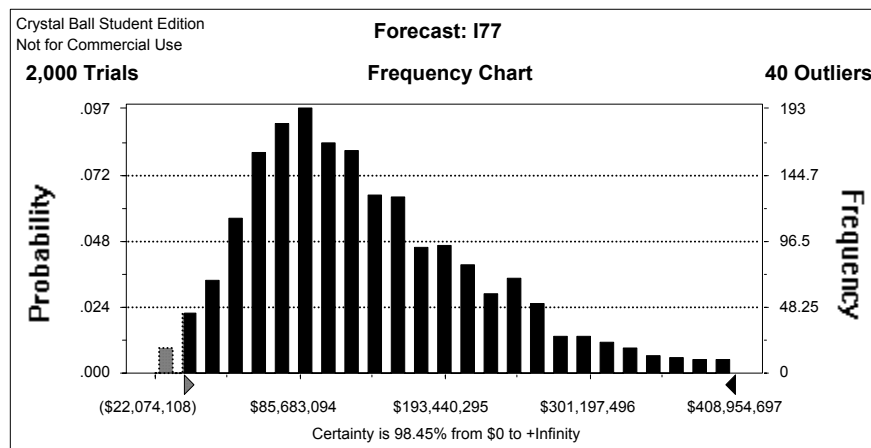
**Cell: I77**

**Summary:**

Certainty Level is 98.45%  
Certainty Range is from \$0 to +Infinity  
Display Range is from (\$22,074,108) to \$408,954,697  
Entire Range is from (\$35,919,798) to \$961,377,148  
After 2,000 Trials, the Std. Error of the Mean is \$2,201,281

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	\$141,318,933
Median	\$120,678,206
Mode	---
Standard Deviation	\$98,444,271
Variance	1E+16
Skewness	1.56
Kurtosis	8.12
Coeff. of Variability	0.70
Range Minimum	(\$35,919,798)
Range Maximum	\$961,377,148
Range Width	\$997,296,945
Mean Std. Error	\$2,201,280.82



**Forecast: I77 (cont'd)**

**Cell: I77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$35,919,798)
10%	\$38,674,264
20%	\$63,145,818
30%	\$82,028,698
40%	\$99,806,228
50%	\$120,678,206
60%	\$144,842,191
70%	\$171,961,666
80%	\$211,016,034
90%	\$263,935,110
100%	\$961,377,148

End of Forecast

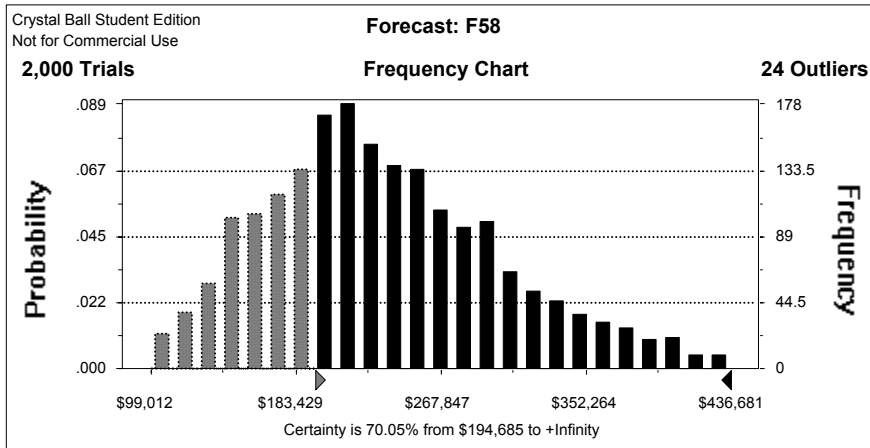
**Forecast:** 30 year retiree bonus accumulation

**Cell: F58**

Summary:

Certainty Level is 70.05%  
Certainty Range is from \$194,685 to +Infinity  
Display Range is from \$99,012 to \$436,681  
Entire Range is from \$82,688 to \$603,629  
After 2,000 Trials, the Std. Error of the Mean is \$1,615

<u>Statistics:</u>	<u>Value</u>
Trials	2000
Mean	\$235,902
Median	\$225,210
Mode	---
Standard Deviation	\$72,245
Variance	\$5,219,329,945
Skewness	0.73
Kurtosis	3.79
Coeff. of Variability	0.31
Range Minimum	\$82,688
Range Maximum	\$603,629
Range Width	\$520,941
Mean Std. Error	\$1,615.45



**Forecast: F58 (cont'd)**

**Cell: F58**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$82,688
10%	\$150,372
20%	\$174,874
30%	\$194,723
40%	\$210,208
50%	\$225,210
60%	\$244,602
70%	\$265,391
80%	\$292,049
90%	\$333,139
100%	\$603,629

End of Forecast

**Forecast:** Probability of bonus equalling delta for 20 year O-5

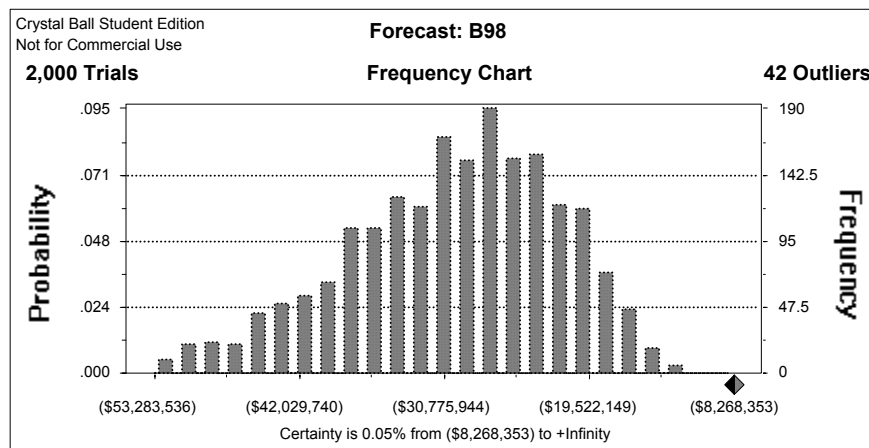
**Cell: B98**

**Summary:**

Certainty Level is 0.05%  
 Certainty Range is from (\$8,268,353) to +Infinity  
 Display Range is from (\$53,283,536) to (\$8,268,353)  
 Entire Range is from (\$77,484,952) to (\$8,103,268)  
 After 2,000 Trials, the Std. Error of the Mean is \$205,987

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	(\$30,624,397)
Median	(\$29,433,528)
Mode	---
Standard Deviation	\$9,211,998
Variance	8E+13
Skewness	-0.88
Kurtosis	4.37
Coeff. of Variability	-0.30
Range Minimum	(\$77,484,952)
Range Maximum	(\$8,103,268)
Range Width	\$69,381,684
Mean Std. Error	\$205,986.53



**Forecast: B98 (cont'd)**

**Cell: B98**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$77,484,952)
10%	(\$42,882,677)
20%	(\$37,597,561)
30%	(\$34,454,765)
40%	(\$31,587,345)
50%	(\$29,433,528)
60%	(\$27,244,898)
70%	(\$25,204,446)
80%	(\$22,929,467)
90%	(\$19,877,402)
100%	(\$8,103,268)

End of Forecast

**Forecast:** Probability of bonus equalling delta for 30 year O-7

**Cell: F98**

Summary:

Certainty Level is 2.45%

Certainty Range is from \$0 to +Infinity

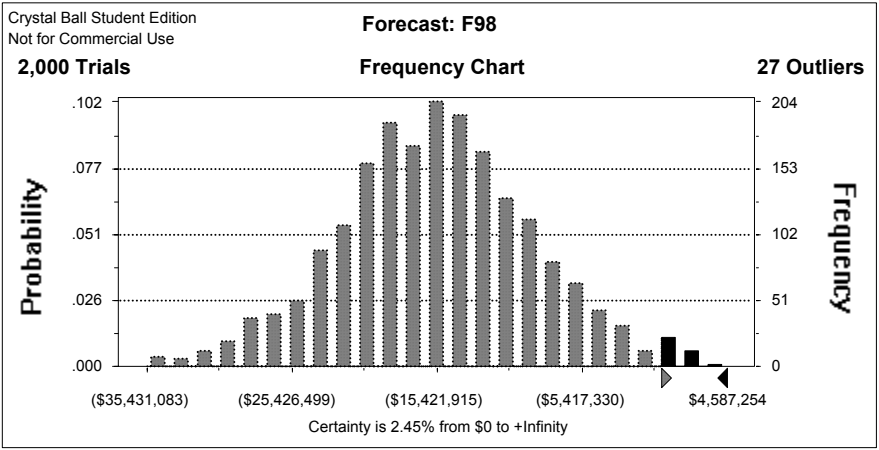
Display Range is from (\$35,431,083) to \$4,587,254

Entire Range is from (\$45,585,010) to \$40,939,120

After 2,000 Trials, the Std. Error of the Mean is \$165,019

Statistics:

	<u>Value</u>
Trials	2000
Mean	(\$15,327,011)
Median	(\$15,502,632)
Mode	---
Standard Deviation	\$7,379,882
Variance	5E+13
Skewness	0.43
Kurtosis	5.92
Coeff. of Variability	-0.48
Range Minimum	(\$45,585,010)
Range Maximum	\$40,939,120
Range Width	\$86,524,130
Mean Std. Error	\$165,019.17



**Forecast: F98 (cont'd)**

**Cell: F98**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$45,585,010)
10%	(\$23,975,180)
20%	(\$20,817,490)
30%	(\$18,868,687)
40%	(\$17,130,831)
50%	(\$15,502,632)
60%	(\$13,878,307)
70%	(\$11,994,079)
80%	(\$9,750,318)
90%	(\$6,515,824)
100%	\$40,939,120

End of Forecast



**Forecast:** Probability of bonus equalling delta for 30 year E-9

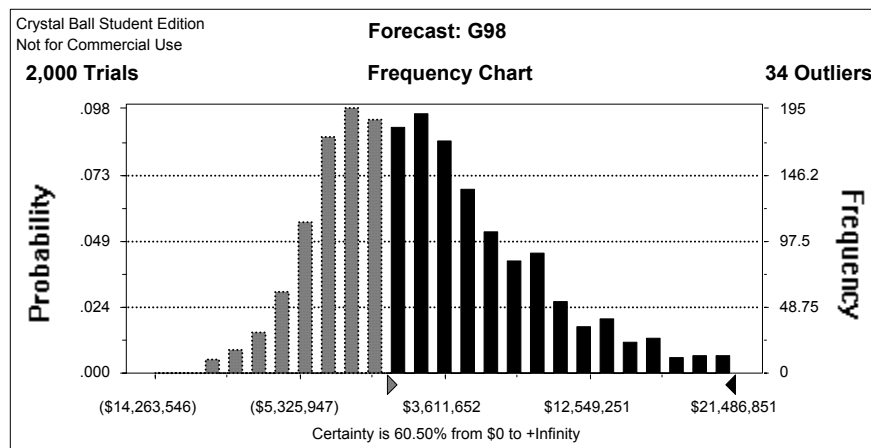
**Cell: G98**

**Summary:**

Certainty Level is 60.50%  
 Certainty Range is from \$0 to +Infinity  
 Display Range is from (\$14,263,546) to \$21,486,851  
 Entire Range is from (\$14,263,546) to \$75,765,419  
 After 2,000 Trials, the Std. Error of the Mean is \$161,358

**Statistics:**

	<u>Value</u>
Trials	2000
Mean	\$2,768,630
Median	\$1,687,671
Mode	---
Standard Deviation	\$7,216,154
Variance	5E+13
Skewness	1.87
Kurtosis	12.77
Coeff. of Variability	2.61
Range Minimum	(\$14,263,546)
Range Maximum	\$75,765,419
Range Width	\$90,028,965
Mean Std. Error	\$161,358.11



**Forecast: G98 (cont'd)**

**Cell: G98**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$14,263,546)
10%	(\$4,568,939)
20%	(\$2,903,317)
30%	(\$1,435,694)
40%	\$114,364
50%	\$1,687,671
60%	\$3,153,424
70%	\$4,991,928
80%	\$7,548,963
90%	\$11,444,565
100%	\$75,765,419

End of Forecast

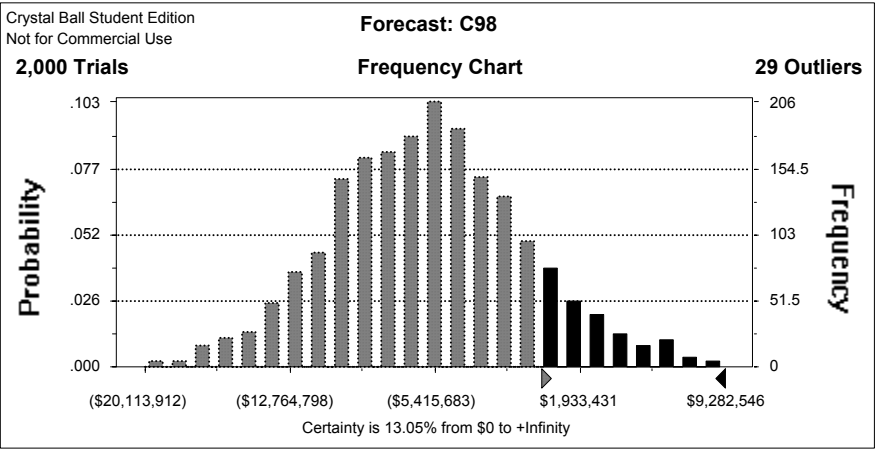
**Forecast:** Probability of bonus equalling delta for 20 year E-8

**Cell: C98**

Summary:

Certainty Level is 13.05%  
Certainty Range is from \$0 to +Infinity  
Display Range is from (\$20,113,912) to \$9,282,546  
Entire Range is from (\$24,059,534) to \$30,400,890  
After 2,000 Trials, the Std. Error of the Mean is \$121,602

<u>Statistics:</u>	<u>Value</u>
Trials	2000
Mean	(\$5,674,496)
Median	(\$5,793,290)
Mode	---
Standard Deviation	\$5,438,217
Variance	3E+13
Skewness	0.50
Kurtosis	5.44
Coeff. of Variability	-0.96
Range Minimum	(\$24,059,534)
Range Maximum	\$30,400,890
Range Width	\$54,460,423
Mean Std. Error	\$121,602.22



**Forecast: C98 (cont'd)**

**Cell: C98**

Percentiles:

Percentile	Value
0%	(\$24,059,534)
10%	(\$12,126,785)
20%	(\$9,900,325)
30%	(\$8,469,409)
40%	(\$7,051,791)
50%	(\$5,793,290)
60%	(\$4,625,896)
70%	(\$3,343,629)
80%	(\$1,624,494)
90%	\$872,801
100%	\$30,400,890

End of Forecast

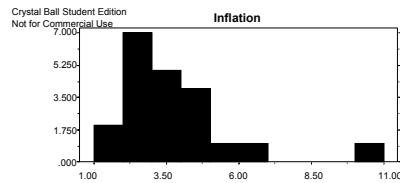
## Assumptions

### Assumption: Inflation

Cell: J3

Custom distribution with parameters:

			<u>Relative Prob.</u>	
Continuous range	1.00	to	2.00	2.00
Continuous range	2.00	to	3.00	7.00
Continuous range	3.00	to	4.00	5.00
Continuous range	4.00	to	5.00	4.00
Continuous range	5.00	to	6.00	1.00
Continuous range	6.00	to	7.00	1.00
Continuous range	10.00	to	11.00	1.00
Total Relative Probability				21.00



### Assumption: G-fund

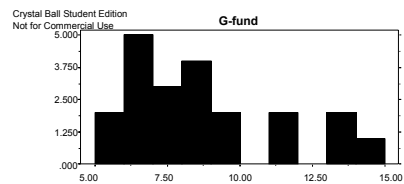
Cell: K3

Custom distribution with parameters:

			<u>Relative Prob.</u>	
Continuous range	5.00	to	6.00	2.00
Continuous range	6.00	to	7.00	5.00
Continuous range	7.00	to	8.00	3.00
Continuous range	8.00	to	9.00	4.00
Continuous range	9.00	to	10.00	2.00
Continuous range	11.00	to	12.00	2.00
Continuous range	13.00	to	14.00	2.00
Continuous range	14.00	to	15.00	1.00
Total Relative Probability				21.00

Assumption: G-fund (cont'd)

Cell: K3

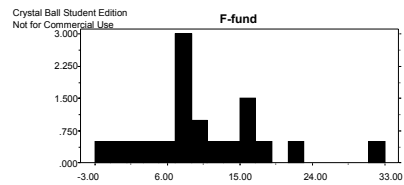


Assumption: F-fund

Cell: L3

Custom distribution with parameters:

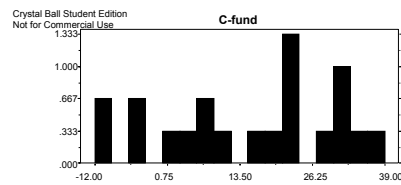
				Relative Prob.	
Continuous range	-3.00	to	-1.00	1.00	
Continuous range	-1.00	to	1.00	1.00	
Continuous range	1.00	to	3.00	1.00	
Continuous range	3.00	to	5.00	1.00	
Continuous range	5.00	to	7.00	1.00	
Continuous range	7.00	to	9.00	6.00	
Continuous range	9.00	to	11.00	2.00	
Continuous range	11.00	to	13.00	1.00	
Continuous range	13.00	to	15.00	1.00	
Continuous range	15.00	to	17.00	3.00	
Continuous range	17.00	to	19.00	1.00	
Continuous range	21.00	to	23.00	1.00	
Continuous range	31.00	to	33.00	1.00	
Total Relative Probability				21.00	



**Assumption: C-fund****Cell: M3**

Custom distribution with parameters:

			<u>Relative Prob.</u>	
Continuous range	-12.00	to	-9.00	2.00
Continuous range	-6.00	to	-3.00	2.00
Continuous range	0.00	to	3.00	1.00
Continuous range	3.00	to	6.00	1.00
Continuous range	6.00	to	9.00	2.00
Continuous range	9.00	to	12.00	1.00
Continuous range	15.00	to	18.00	1.00
Continuous range	18.00	to	21.00	1.00
Continuous range	21.00	to	24.00	4.00
Continuous range	27.00	to	30.00	1.00
Continuous range	30.00	to	33.00	3.00
Continuous range	33.00	to	36.00	1.00
Continuous range	36.00	to	39.00	1.00
Total Relative Probability			21.00	

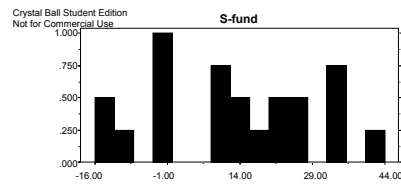
**Assumption: S-fund****Cell: N3**

Custom distribution with parameters:

			<u>Relative Prob.</u>	
Continuous range	-16.00	to	-12.00	2.00
Continuous range	-12.00	to	-8.00	1.00
Continuous range	-4.00	to	0.00	4.00
Continuous range	8.00	to	12.00	3.00
Continuous range	12.00	to	16.00	2.00
Continuous range	16.00	to	20.00	1.00
Continuous range	20.00	to	24.00	2.00
Continuous range	24.00	to	28.00	2.00
Continuous range	32.00	to	36.00	3.00
Continuous range	40.00	to	44.00	1.00
Total Relative Probability			21.00	

**Assumption: S-fund (cont'd)**

**Cell: N3**

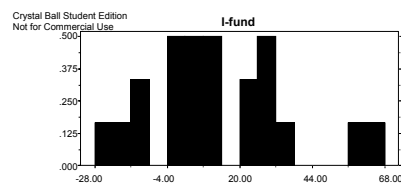


**Assumption: I-fund**

**Cell: O3**

Custom distribution with parameters:

				Relative Prob.
Continuous range	-28.00	to	-22.00	1.00
Continuous range	-22.00	to	-16.00	1.00
Continuous range	-16.00	to	-10.00	2.00
Continuous range	-4.00	to	2.00	3.00
Continuous range	2.00	to	8.00	3.00
Continuous range	8.00	to	14.00	3.00
Continuous range	20.00	to	26.00	2.00
Continuous range	26.00	to	32.00	3.00
Continuous range	32.00	to	38.00	1.00
Continuous range	56.00	to	62.00	1.00
Continuous range	62.00	to	68.00	1.00
Total Relative Probability				21.00



End of Assumptions

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## APPENDIX J      DETAILED REPORT OF MODEL OUTPUT FOR 'WHAT IF' SCENARIO

### Crystal Ball Report

Simulation started on 5/16/02 at 11:30:40

Simulation stopped on 5/16/02 at 11:32:56

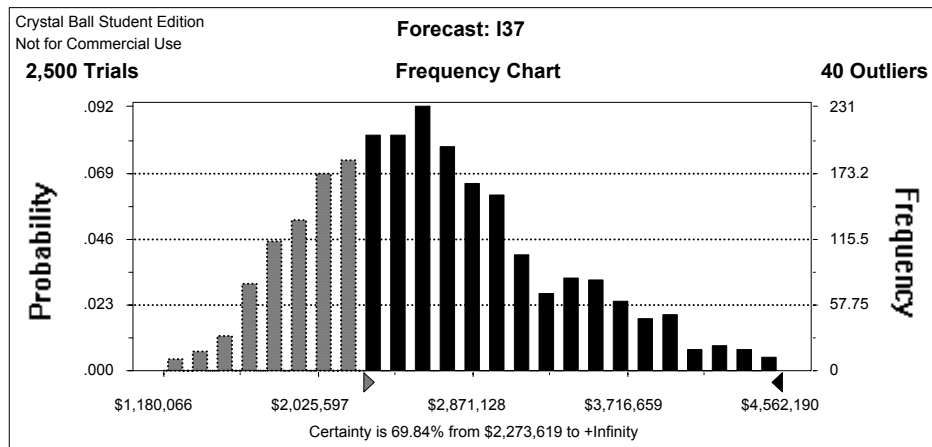
**Forecast:**      30 year O-7 Accumulation

**Cell:** I37

**Summary:**

Certainty Level is 69.84%  
 Certainty Range is from \$2,273,619 to +Infinity  
 Display Range is from \$1,180,066 to \$4,562,190  
 Entire Range is from \$1,180,066 to \$7,304,674  
 After 2,500 Trials, the Std. Error of the Mean is \$14,264

Statistics:	<u>Value</u>
Trials	2500
Mean	\$2,684,349
Median	\$2,586,207
Mode	---
Standard Deviation	\$713,187
Variance	5E+11
Skewness	0.91
Kurtosis	4.59
Coeff. of Variability	0.27
Range Minimum	\$1,180,066
Range Maximum	\$7,304,674
Range Width	\$6,124,608
Mean Std. Error	\$14,263.74



**Forecast: I37 (cont'd)**

**Cell: I37**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$1,180,066
10%	\$1,859,298
20%	\$2,077,640
30%	\$2,269,572
40%	\$2,431,416
50%	\$2,586,207
60%	\$2,750,366
70%	\$2,944,338
80%	\$3,208,642
90%	\$3,650,379
100%	\$7,304,674

End of Forecast

**Forecast:** 30 year E-9 Accumulation

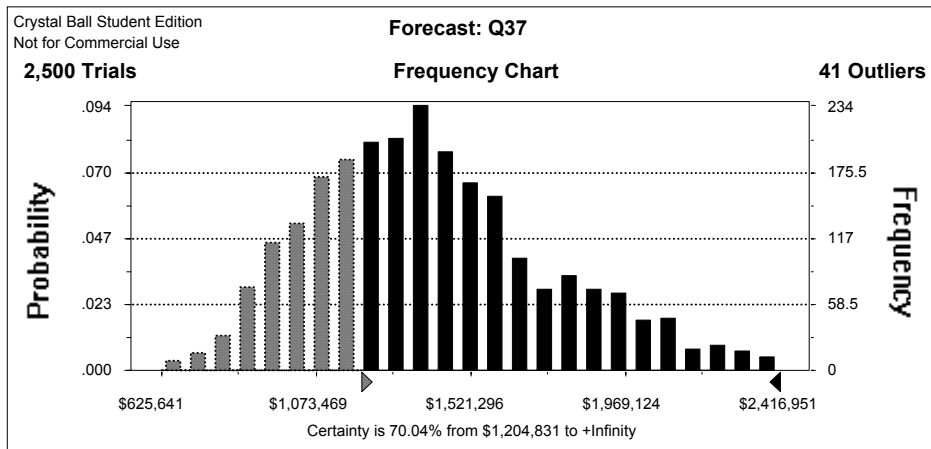
**Cell: Q37**

Summary:

Certainty Level is 70.04%  
Certainty Range is from \$1,204,831 to +Infinity  
Display Range is from \$625,641 to \$2,416,951  
Entire Range is from \$623,870 to \$3,844,361  
After 2,500 Trials, the Std. Error of the Mean is \$7,553

Statistics:

	<u>Value</u>
Trials	2500
Mean	\$1,424,142
Median	\$1,373,532
Mode	---
Standard Deviation	\$377,661
Variance	1E+11
Skewness	0.90
Kurtosis	4.55
Coeff. of Variability	0.27
Range Minimum	\$623,870
Range Maximum	\$3,844,361
Range Width	\$3,220,491
Mean Std. Error	\$7,553.23



**Forecast: Q37 (cont'd)**

**Cell: Q37**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$623,870
10%	\$986,100
20%	\$1,101,882
30%	\$1,206,596
40%	\$1,291,378
50%	\$1,373,532
60%	\$1,456,214
70%	\$1,561,401
80%	\$1,703,283
90%	\$1,938,595
100%	\$3,844,361

End of Forecast

**Forecast:** 20 year O-5 Probability for TSP Only option

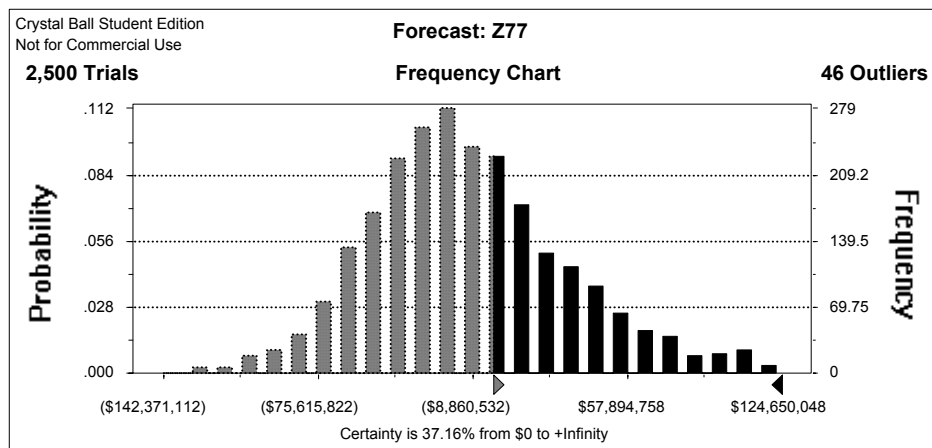
**Cell: Z77**

**Summary:**

Certainty Level is 37.16%  
 Certainty Range is from \$0 to +Infinity  
 Display Range is from (\$142,371,112) to \$124,650,048  
 Entire Range is from (\$150,849,824) to \$344,874,950  
 After 2,500 Trials, the Std. Error of the Mean is \$1,015,622

**Statistics:**

	<u>Value</u>
Trials	2500
Mean	(\$7,420,518)
Median	(\$14,339,477)
Mode	---
Standard Deviation	\$50,781,107
Variance	3E+15
Skewness	1.34
Kurtosis	7.80
Coeff. of Variability	-6.84
Range Minimum	(\$150,849,824)
Range Maximum	\$344,874,950
Range Width	\$495,724,774
Mean Std. Error	\$1,015,622.15



**Forecast: Z77 (cont'd)**

**Cell: Z77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$150,849,824)
10%	(\$62,047,002)
20%	(\$45,211,858)
30%	(\$34,008,542)
40%	(\$24,076,266)
50%	(\$14,339,477)
60%	(\$3,140,646)
70%	\$8,904,030
80%	\$25,355,626
90%	\$52,566,531
100%	\$344,874,950

End of Forecast

**Forecast:** 20 year O-5 Accumulation

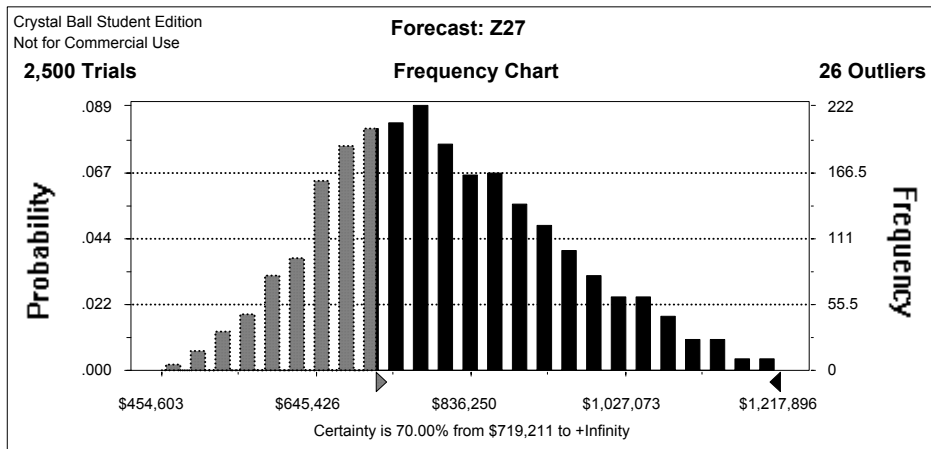
**Cell: Z27**

Summary:

Certainty Level is 70.00%  
Certainty Range is from \$719,211 to +Infinity  
Display Range is from \$454,603 to \$1,217,896  
Entire Range is from \$451,297 to \$1,701,837  
After 2,500 Trials, the Std. Error of the Mean is \$3,046

Statistics:

	<u>Value</u>
Trials	2500
Mean	\$807,041
Median	\$788,239
Mode	---
Standard Deviation	\$152,321
Variance	\$23,201,650,098
Skewness	0.65
Kurtosis	4.00
Coeff. of Variability	0.19
Range Minimum	\$451,297
Range Maximum	\$1,701,837
Range Width	\$1,250,540
Mean Std. Error	\$3,046.42



**Forecast: Z27 (cont'd)**

**Cell: Z27**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$451,297
10%	\$629,961
20%	\$679,662
30%	\$719,155
40%	\$754,382
50%	\$788,239
60%	\$829,012
70%	\$873,842
80%	\$927,708
90%	\$1,010,184
100%	\$1,701,837

End of Forecast

**Forecast:** 20 year E-8 Accumulation

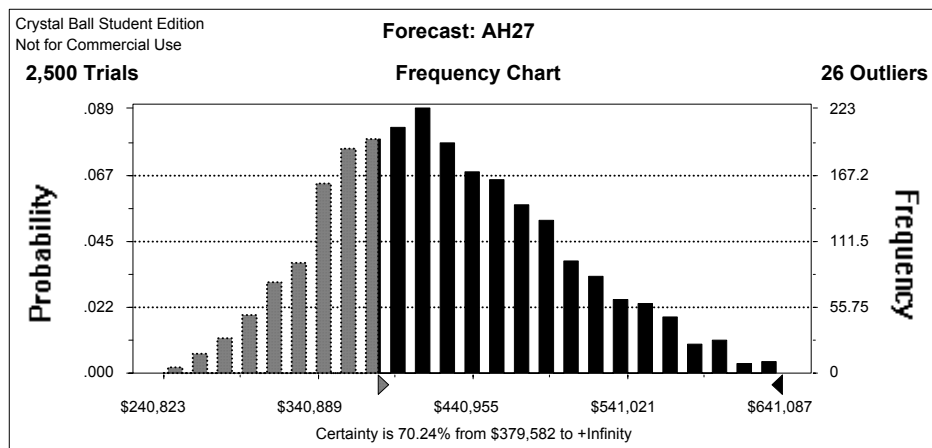
**Cell:** AH27

**Summary:**

Certainty Level is 70.24%  
Certainty Range is from \$379,582 to +Infinity  
Display Range is from \$240,823 to \$641,087  
Entire Range is from \$238,936 to \$893,993  
After 2,500 Trials, the Std. Error of the Mean is \$1,595

**Statistics:**

	<u>Value</u>
Trials	2500
Mean	\$426,122
Median	\$416,330
Mode	---
Standard Deviation	\$79,747
Variance	\$6,359,606,229
Skewness	0.64
Kurtosis	3.98
Coeff. of Variability	0.19
Range Minimum	\$238,936
Range Maximum	\$893,993
Range Width	\$655,057
Mean Std. Error	\$1,594.94



**Forecast: AH27 (cont'd)****Cell: AH27**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	\$238,936
10%	\$333,101
20%	\$359,042
30%	\$380,095
40%	\$398,458
50%	\$416,330
60%	\$437,744
70%	\$460,957
80%	\$489,581
90%	\$533,141
100%	\$893,993

End of Forecast

**Forecast: 20 year E-8 Probability for TSP Only Option****Cell: AH77**

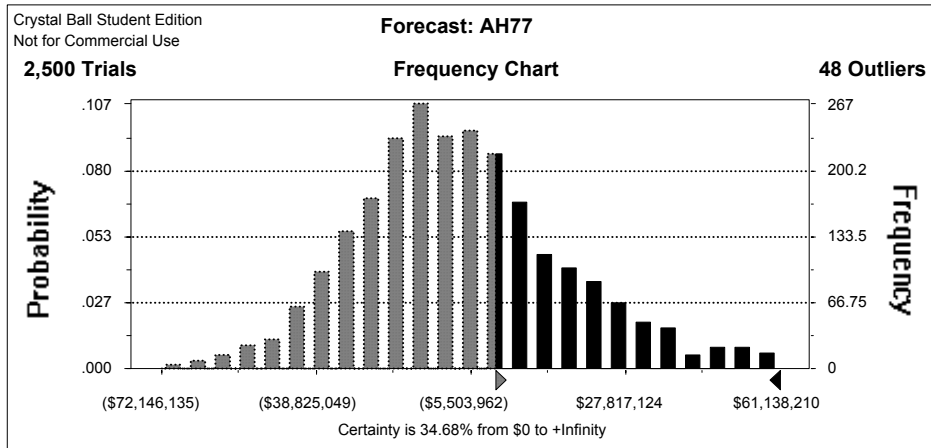
Summary:

Certainty Level is 34.68%  
 Certainty Range is from \$0 to +Infinity  
 Display Range is from (\$72,146,135) to \$61,138,210  
 Entire Range is from (\$81,999,432) to \$178,210,744  
 After 2,500 Trials, the Std. Error of the Mean is \$531,209

Statistics:

	<u>Value</u>
Trials	2500
Mean	(\$6,000,898)
Median	(\$9,259,370)
Mode	---
Standard Deviation	\$26,560,465
Variance	7E+14
Skewness	1.29
Kurtosis	7.68
Coeff. of Variability	-4.43
Range Minimum	(\$81,999,432)
Range Maximum	\$178,210,744
Range Width	\$260,210,176
Mean Std. Error	\$531,209.31





**Forecast: AH77 (cont'd)**

**Cell: AH77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$81,999,432)
10%	(\$34,628,139)
20%	(\$25,935,339)
30%	(\$19,787,465)
40%	(\$14,560,734)
50%	(\$9,259,370)
60%	(\$3,587,761)
70%	\$2,528,577
80%	\$11,270,104
90%	\$25,600,985
100%	\$178,210,744

End of Forecast

**Forecast:** 30 year E-9 probability for TSP Only Option

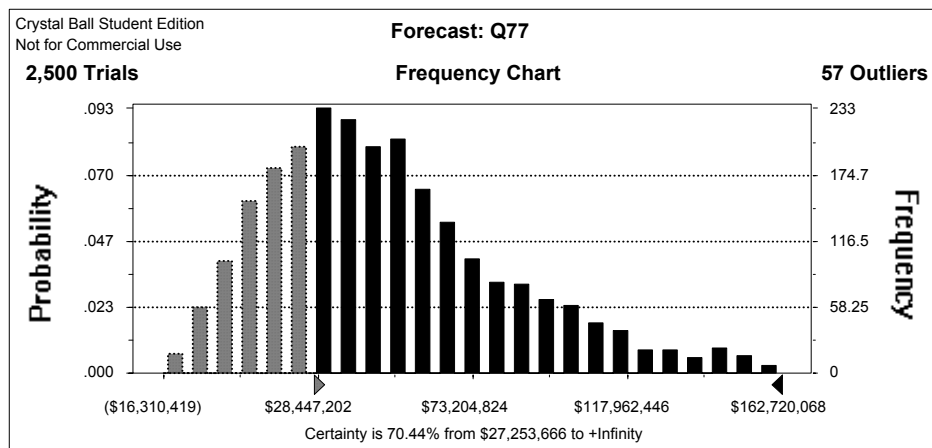
**Cell: Q77**

**Summary:**

Certainty Level is 70.44%  
 Certainty Range is from \$27,253,666 to +Infinity  
 Display Range is from (\$16,310,419) to \$162,720,068  
 Entire Range is from (\$23,683,845) to \$283,936,109  
 After 2,500 Trials, the Std. Error of the Mean is \$804,970

**Statistics:**

	<u>Value</u>
Trials	2500
Mean	\$51,205,502
Median	\$43,548,428
Mode	---
Standard Deviation	\$40,248,508
Variance	2E+15
Skewness	1.36
Kurtosis	6.02
Coeff. of Variability	0.79
Range Minimum	(\$23,683,845)
Range Maximum	\$283,936,109
Range Width	\$307,619,954
Mean Std. Error	\$804,970.16



**Forecast: Q77 (cont'd)**

**Cell: Q77**

Percentiles:

<u>Percentile</u>	<u>Value</u>
0%	(\$23,683,845)
10%	\$8,443,382
20%	\$19,170,303
30%	\$27,576,860
40%	\$35,252,284
50%	\$43,548,428
60%	\$52,754,593
70%	\$62,655,268
80%	\$77,959,846
90%	\$103,182,763
100%	\$283,936,109

End of Forecast

**Forecast:** 30 year O-7 probability for TSP Only Option

**Cell: I77**

Summary:

Certainty Level is 70.36%  
Certainty Range is from \$41,065,606 to +Infinity  
Display Range is from (\$43,809,235) to \$291,223,031  
Entire Range is from (\$57,622,602) to \$528,306,754  
After 2,500 Trials, the Std. Error of the Mean is \$1,495,817

Statistics:

	<u>Value</u>
Trials	2500
Mean	\$84,904,296
Median	\$70,643,646
Mode	---
Standard Deviation	\$74,790,866
Variance	6E+15
Skewness	1.36
Kurtosis	6.08
Coeff. of Variability	0.88
Range Minimum	(\$57,622,602)
Range Maximum	\$528,306,754
Range Width	\$585,929,356
Mean Std. Error	\$1,495,817.32



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